Coalbed Methane/ Natural Gas in Coal

Preliminary Findings

Prepared by
The CBM/NGC Multi-Stakeholder Advisory Committee

July 2005

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Service Alberta, toll-free 310-4455
or
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Table of Contents

1.0	Executive Summary and Recommendations	3
2.0	Introduction	14
3.0	Water	17
4.0	Surface/Air	29
5.0	Royalties	34
6.0	Tenure	37
7.0	Broad-Based CBM/NGC Issues	42
8.0	Best Practices Manual	48
9.0	Non CBM/NGC Specific Issues	49
	Acronyms and Glossary of Terms	52

APPENDICES

Appendix A – MAC Members

Appendix B – Out-of-Scope Issues

Appendix C – CBM/NGC Well Activity & Production Fact Sheet and Map of Potential CBM/NGC Coal Zones

Appendix D – Summary of Regulatory Requirements for CBM/NGC Activities - Alberta

Appendix E – CASA Report, 'Flaring and Venting Regulations for Coalbed Methane Final Report'

1.0 Executive Summary and Recommendations

1.1. CBM/NGC Review

The Coalbed Methane/Natural Gas in Coal (CBM/NGC) Multi-Stakeholder Advisory Committee (MAC) was formed in November 2003 as part of a multi-phase review initiated by Alberta Energy (DOE) to determine if there are areas where the existing rules and regulations can be improved to handle the specific issues related to CBM/NGC. The review has involved multi-stakeholder and public consultation through a variety of methods, including public information sessions held across the province in the spring of 2004. Information from other jurisdictions and from Alberta CBM/NGC operations is also being researched. The ultimate objective is to ensure the economic benefits of CBM/NGC development are balanced with the protection of land, air and water resources.

1.2 Issues

The MAC is playing a key role in the CBM/NGC review. The purpose of the MAC is to:

- Guide the consultation process, including the development of a consultation framework to ensure issues are adequately addressed
- Determine the specific CBM/NGC issues to be addressed
- Coordinate, consolidate, evaluate and submit recommendations to the government

The MAC found a number of issues unique to CBM/NGC development, primarily dealing with water. Other issues impact all oil and gas development, but may be intensified by growing CBM/NGC development, with its potential for a high density of surface sites and associated cumulative impacts.

1.3 Purpose of the Preliminary Findings

This preliminary findings document is being distributed to share information and to seek input from stakeholders and members of the public before the recommendations are finalized. Comments and input are requested by September 30, 2005. This document along with a comment form can be found on the DOE web site at http://www.energy.gov.ab.ca/245.asp.

The MAC will review and evaluate the comments and input for incorporation into a final report. Once the final report has been prepared, the MAC will submit it to the Assistant Deputy Ministers Sponsors' Committee in the fourth quarter of 2005 and it will be distributed to the appropriate government departments and agencies for consideration and response. The final report will be posted on the DOE web site.

1.4 Recommendations

The MAC believes that all the recommendations in this document are important and should be implemented as quickly as possible. At the same time, the MAC acknowledges that there may not be sufficient resources to implement all the recommendations at once. Furthermore, there may be technical reasons or an existing initiative that might result in some recommendations being implemented

before others. As well, some recommendations may require considerable additional review and additional stakeholder consultation. This may also include the need for a transition period for companies to develop, learn and implement best practices on an industry-wide basis. Agencies and departments also need some flexibility in how they implement the recommendations.

Although the MAC believes that all the recommendations it is putting forward are important, to give some guidance in implementation, the following 10 recommendations are proposed for early action.

Top Ten Recommendations

Issue	#	Recommendation
Protecting the Environment	4.3.1	To protect the environment and minimize the cumulative impacts from CBM/NGC development, a government-led multi-stakeholder committee, such as that being set up under ASRD's Integrated Land Management Program if appropriate, should undertake the following sequentially: 1. Review integrated land management principles, policies and practices relating to CBM/NGC to ensure they maintain the integrity and function of the land, taking into account all uses. 2. Identify environmentally sensitive and threatened areas (including areas not already designated) that are not appropriate for CBM/NGC development. 3. Recommend needed baseline studies to identify any areas where the integrated land management process may not adequately protect environmentally sensitive areas from the impacts of CBM/NGC development and make appropriate recommendations for the protection of these areas, taking into account all uses. 4. Provide any such recommendations or data gathered from baseline studies to the appropriate existing program/group for consideration and/or implementation in their process.
Approval Process to Protect Aquifers and Water Supplies	3.3.2	AENV and the EUB should develop a 'decision tree' approach for reviewing CBM/NGC applications involving non-saline water production. This process should address the level of risk to aquifers and users by considering factors such as hydrogeological settings, existing users, salinity and expected volumes of water produced. The decision tree should be developed with stakeholder input and should: ♦ Incorporate the threshold volume of produced non-saline water, below which the Code of Practice would apply (See Recommendation 3.3.1). ♦ Consider geographical areas where the risk to the quality or quantity of water supplies might be greater than in other areas. It will be critical to know and understand those areas that may require special or additional attention from AENV. (See Recommendation 3.2.1) ♦ Ensure that applications for CBM/NGC wells that would produce volumes of non-saline water in excess of threshold volumes trigger accelerated aquifer studies. ♦ Ensure appropriate compliance with the decision tree.

Issue	#	Recommendation
Project Based Planning and Disclosure	7.2.1	The EUB and AENV should work with stakeholders to review the application processes for intense CBM/NGC developments to enhance and promote project-based planning and disclosure. This would allow: ♦ Definition of intense project developments ♦ Full project disclosure ♦ Improved community consultation ♦ Enhanced impact assessment ♦ Review of mitigation measures
Improved Scientific Information	3.2.1	The following actions should be undertaken in collaboration with stakeholders to improve the scientific information on the province's water resources: ♦ AENV should expand its current monitoring network and data management system, beginning in areas that could experience intense CBM/NGC development. ♦ AENV should complete its inventory of groundwater in the province, beginning in areas that could experience intense CBM/NGC development. Coals containing non-saline water aquifers with potential CBM/NGC activity should be targeted. The inventory should include characteristics such as location, lateral extent, and porosity, as well as recharge rates and hydraulic connectivity between aquifers. ♦ The EUB and Alberta Geological Survey (AGS) should complete the Base of Groundwater Protection mapping project, beginning in areas that could experience intense CBM/NGC development. ♦ AENV and the EUB, together with industry, should investigate the potential for unintended effects of CBM/NGC development on surrounding aquifers. ♦ AENV should identify and characterize areas where CBM/NGC approval requirements need to be more rigorous due to potential impacts on non-saline aquifers, other water bodies and other water users. Maps of these areas should be made available to regulators, industry and stakeholders. ♦ Before drilling and production from a potentially non-saline aquifer where water volumes are anticipated to be above a threshold limit, CBM/NGC operators should obtain baseline data, including gas and mineral content and other indicators of water quality, flow rate/yield and water levels. In lower risk cases and below the threshold volume, less information may be required. The data would be included in a public database subject to confidentiality provisions.
Methane Migration and Release	3.6.1	AENV and the EUB should work with industry to investigate the potential for methane migration or release to water wells as a result of CBM/NGC depressurization.
Best Practices for CBM/NGC	8.1.1	Industry, government and other stakeholders should work together to develop, document and implement best practices for CBM/NGC operations.

Issue	#	Recommendation
Information on Mannville Coals	5.2.1*	The DOE in consultation with stakeholders should determine an appropriate level of royalty reduction for a period of up to five years to encourage the drilling of saline CBM/NGC wells in the Mannville formation for the purposes of acquiring information. This pilot-type program would provide and make public data on the economics, geological and technical aspects of drilling in formations with saline water, with data aggregated in cases where competitiveness would be jeopardized. **One group did not support this recommendation.*
Approval Process to Protect Aquifers and Water Supplies	3.3.5	AENV and the EUB should work with stakeholders, including the environmental service industry, to develop standard procedures and reporting requirements for the sampling, analysis and monitoring of both saline and non-saline water quality and quantity for CBM/NGC wells and potentially affected non-saline water wells. Quality assurance and quality control measures should be developed, as well as a range of tests, depending on the type of water being tested, including: ♦ Testing for a variety of metals and other impurities, as well as total dissolved solids. ♦ Testing for the presence of gas in water wells. The presence or lack of gas should be included on the water analysis report or file. (See Section 3.6 for discussion on methane migration and release.) ♦ Non-saline water produced from coal seams should be tested for its intended use or to determine what it can be used for.
Accessible Current Public Information and Communication	7.5.1	Industry, regulators and other stakeholders should increase the opportunity for dialogue, education and awareness of the public, surface and subsurface rights holders, leaseholders and industry on the possible impacts resulting from CBM/NGC development, and how the use of the land will be affected.
Drilling Fluids	3.4.2	The EUB and AENV should, in cooperation with other organizations such as the Alberta Research Council, investigate whether CBM/NGC drilling and completion practices such as using dugout water and untreated river water may affect aquifers, and review regulations to determine whether changes are needed. They should also consolidate and review studies regarding drilling and completion fluid constituents and their potential for deleterious effects.

Complete List of MAC CBM/NGC Recommendations

Issue	#	Recommendation
Water		
Improved Scientific Information	3.2.1	The following actions should be undertaken in collaboration with stakeholders to improve the scientific information on the province's water resources: ♦ AENV should expand its current monitoring network and data management system, beginning in areas that could experience intense CBM/NGC development. ♦ AENV should complete its inventory of groundwater in the province, beginning in areas that could experience intense CBM/NGC development. Coals containing non-saline water aquifers with potential CBM/NGC activity should be targeted. The inventory should include characteristics such as location, lateral extent, and porosity, as well as recharge rates and hydraulic connectivity between aquifers. ♦ The EUB and Alberta Geological Survey (AGS) should complete the Base of Groundwater Protection mapping project, beginning in areas that could experience intense CBM/NGC development. ♦ AENV and the EUB, together with industry, should investigate the potential for unintended effects of CBM/NGC development on surrounding aquifers. ♦ AENV should identify and characterize areas where CBM/NGC approval requirements need to be more rigorous due to potential impacts on non-saline aquifers, other water bodies and other water users. Maps of these areas should be made available to regulators, industry and stakeholders. ♦ Before drilling and production from a potentially non-saline aquifer where water volumes are anticipated to be above a threshold limit, CBM/NGC operators should obtain baseline data, including gas and mineral content and other indicators of water quality, flow rate/yield and water levels. In lower risk cases and below the threshold volume, less information may be required. The data would be included in a public database subject to confidentiality provisions.
Approval Process to Protect Aquifers and Water Supplies	3.3.1	AENV should establish a multi-stakeholder technical committee to determine an appropriate, scientifically-based threshold for produced non-saline water below which a simplified approval under a Code of Practice for production or use of the water would apply. Threshold numbers should be developed for an individual well and on an areal basis. An interim threshold number should be determined and applied by AENV until the committee completes its work. AENV should also establish a Code of Practice with stakeholder input.
	3.3.2	AENV and the EUB should develop a 'decision tree' approach for reviewing CBM/NGC applications involving non-saline water production. This process should address the level of risk to aquifers and users by considering factors such as hydrogeological settings, existing users, salinity and expected volumes of water produced. The decision tree should be developed with stakeholder input and should: ♦ Incorporate the threshold volume of produced non-saline water, below

Issue	#	Recommendation
		which the Code of Practice would apply (See Recommendation 3.3.1). ♦ Consider geographical areas where the risk to the quality or quantity of water supplies might be greater than in other areas. It will be critical to know and understand those areas that may require special or additional attention from AENV. (See Recommendation 3.2.1) ♦ Ensure that applications for CBM/NGC wells that would produce volumes of non-saline water in excess of threshold volumes trigger accelerated aquifer studies. ♦ Ensure appropriate compliance with the decision tree.
	3.3.3	AENV's Guidelines for Groundwater Diversion for CBM/NGC Development (April 2004) should be enhanced and required for a single well or group of wells where non-saline water is present or anticipated. ♦ The guidelines should be reflected in the risk-based 'decision tree' process. ♦ To ensure consistency, minimum conditions for approvals should be standardized across the province, with additional site-specific conditions possible. ♦ The components of the field-verified survey of all water sources should be reviewed to ensure their appropriateness and effectiveness with regard to the scale of the project. ♦ A province-wide review of existing CBM/NGC wells should be undertaken to ensure all guidelines have been met.
	3.3.4	AENV should clarify and communicate the existing rules regarding how much drawdown is allowed during CBM/NGC depressurization in a confined non-saline aquifer to ensure aquifer protection.
	3.3.5	AENV and the EUB should work with stakeholders, including the environmental service industry, to develop standard procedures and reporting requirements for the sampling, analysis and monitoring of both saline and non-saline water quality and quantity for CBM/NGC wells and potentially affected non-saline water wells. Quality assurance and quality control measures should be developed, as well as a range of tests, depending on the type of water being tested, including: ♦ Testing for a variety of metals and other impurities, as well as total dissolved solids. ♦ Testing for the presence of gas in water wells. The presence or lack of gas should be included on the water analysis report or file. (See Section 3.6 for discussion on methane migration and release). ♦ Non-saline water produced from coal seams should be tested for its intended use or to determine what it can be used for.
	3.3.6	AENV and the EUB should review drilling and completion practices for new and recompleted water and energy wells, ensuring regulations are appropriate for the purpose of the well. Topics to be addressed should include: drilling and completion fluids; well bore integrity/aquifer isolation; casing types; and completions, etc. This review should include the drilling and abandonment of temporary water source wells.
Drilling Fluids	3.4.1	The EUB and AENV should communicate with CBM/NGC operators, drilling contractors and water well drillers regarding current and future requirements to protect non-saline aquifers. Action should be taken if there is evidence that an existing well has not met AENV's Guidelines for

Issue	#	Recommendation
		Groundwater Diversion for CBM/NGC Development (April 2004) (recommended for revision in Recommendation 3.3.3). Any company producing non-saline water from a CBM/NGC well without authority for a diversion above the threshold volumes should immediately stop operations and notify provincial regulators to initiate the authorization process.
	3.4.2	The EUB and AENV should, in cooperation with other organizations such as the Alberta Research Council, investigate whether CBM/NGC drilling and completion practices such as using dugout water and untreated river water may affect aquifers, and review regulations to determine whether changes are needed. They should also consolidate and review studies regarding drilling and completion fluid constituents and their potential for deleterious effects.
Promoting the Wise Use and Conservation of Water	3.5.1	AENV and the EUB, with stakeholder input, should: • Review existing requirements for deep well disposal of non-saline produced water and consider alternatives, if appropriate. • Establish criteria for the beneficial use of non-saline produced water. • Develop guidelines, including a requirement for a beneficial use assessment for non-saline produced water and include them in the decision-tree approval process. • Revisit authorized diversions of non-saline groundwater for industrial use when CBM/NGC developments create new sources of water in the area.
	3.5.2	AENV and the EUB, with stakeholder input, should establish criteria for the beneficial use of marginally saline produced water. AENV and the EUB, with stakeholder input, should then develop guidelines, including a requirement for a beneficial use assessment for marginally saline produced water, and include them in the decision-tree approval process.
	3.5.3	AENV, the EUB and the DOE should work with the water producing and environmental services industries to promote the development of new technology or the application of existing technology that can take advantage of saline and marginally saline produced water.
Methane Migration and Release	3.6.1	AENV and the EUB should work with industry to investigate the potential for methane migration or release to water wells as a result of CBM/NGC depressurization.
	3.6.2	Based on the results of the previous recommendation, AENV and the EUB should implement appropriate prevention, monitoring and mitigation measures to address methane migration or release, if necessary.
Surface/Air		
Land Management to Address Cumulative Impacts	4.2.1	The EUB should review its regulatory process for ways to support minimal surface disturbance and reduced cumulative impact associated with CBM/NGC development.
Protecting the Environment	4.3.1	To protect the environment and minimize the cumulative impacts from CBM/NGC development, a government-led multi-stakeholder committee, such as that being set up under ASRD's Integrated Land Management Program if appropriate, should undertake the following sequentially: 1. Review integrated land management principles, policies and practices

Issue	#	Recommendation
		relating to CBM/NGC to ensure they maintain the integrity and function of the land, taking into account all uses. 2. Identify environmentally sensitive and threatened areas (including areas not already designated) that are not appropriate for CBM/NGC development. 3. Recommend needed baseline studies to identify any areas where the integrated land management process may not adequately protect environmentally sensitive areas from the impacts of CBM/NGC development and make appropriate recommendations for the protection of these areas, taking into account all uses. 4. Provide any such recommendations or data gathered from baseline studies to the appropriate existing program/group for consideration and/or implementation in their process.
	4.3.2	Government and all relevant industries should work together to improve the science and technology for remediation and reclamation of the land in sensitive areas that could be impacted by CBM/NGC development.
Royalties		
Information on Mannville Coals	5.2.1*	The DOE in consultation with stakeholders should determine an appropriate level of royalty reduction for a period of up to five years to encourage the drilling of saline CBM/NGC wells in the Mannville formation for the purposes of acquiring information. This pilot-type program would provide and make public data on the economics, geological and technical aspects of drilling in formations with saline water, with data aggregated in cases where competitiveness would be jeopardized. **One group did not support this recommendation.*
	5.2.2*	The Alberta and the federal governments should consider recognizing Canada's CBM/NGC potential through the adjustment of tax regimes, including corporate income tax and freehold mineral tax, to encourage a five-year pilot-type drilling program for saline CBM/NGC wells in the Mannville formation for the purposes of acquiring information. **One group did not support this recommendation.*
	5.2.3*	The DOE in consultation with stakeholders should consider the use of appropriate fiscal tools to encourage the use of saline water from CBM/NGC development to replace non-saline water for enhanced oil recovery and other industrial uses. **One group did not support this recommendation.*
Tenure		
Ownership Issues	6.2.1	The Alberta Government should make Crown lessees, freehold owners and industry aware of the risks and associated impacts of split title ownership.
	6.2.2	The Alberta Government should set up a process to facilitate parties coming together to work toward resolution of split-title ownership issues.
Acquiring New Natural Gas Rights in Shallow Zones	6.3.1	The DOE should review and clarify the criteria for Section 18 Notices of Non-Productivity (See Section 18 in the Petroleum and Natural Gas Tenure Regulation) and aggressively serve these notices. Section 18 Notices on existing agreements should continue to be subject to deeper rights reversion.

Issue	#	Recommendation
Holding Crown-Leased Natural Gas Rights	6.5.1	The DOE should allow companies an additional one-year continuation under Section 17 of the Petroleum and Natural Gas Tenure Regulation. This additional year would require industry to submit evidence of work conducted during the first continuation period. Also, companies would be charged an increased non-refundable acceptance fee to retain the lands for the second year. The DOE would require additional analysis and consultation on the amount of the fee.
Broad-Based CBM/NGC Issues		
Project Based Planning and Disclosure	7.2.1	The EUB and AENV should work with stakeholders to review the application processes for intense CBM/NGC developments to enhance and promote project-based planning and disclosure. This would allow: ♦ Definition of intense project developments ♦ Full project disclosure ♦ Improved community consultation ♦ Enhanced impact assessment ♦ Review of mitigation measures
Public Consultation Notification Distances	7.3.1	The EUB, AENV and ASRD with stakeholder input should review all guidelines that relate to public input opportunities and notification to ensure the guidelines are appropriate for CBM/NGC development.
Enhanced Regulatory Coordination	7.4.1	The EUB, AENV and ASRD should improve the coordination of their CBM/NGC-related application and surveillance processes and develop electronic solutions to facilitate data exchange.
Accessible Current Public Information and Communication	7.5.1	Industry, regulators and other stakeholders should increase the opportunity for dialogue, education and awareness of the public, surface and subsurface rights holders, leaseholders and industry on the possible impacts resulting from CBM/NGC development, and how the use of the land will be affected.
	7.5.2	The EUB and AENV should consolidate CBM/NGC data in a publicly accessible and user-friendly database that includes information on postings, wells (e.g., drill logs), applications and approvals, chemical analyses and water production rates, well location, coal formation, production intervals, and monitoring data. The availability of data should be subject to the normal provisions of confidentiality
	7.5.3	The EUB should create an easy-to-understand public explanation for 'wells per section per pool' as it refers to CBM/NGC development.
	7.5.4	The EUB and the Department of Municipal Affairs along with other stakeholders should clarify and communicate the requirements, roles and responsibilities related to setbacks.
	7.5.5	Government and industry should continue to work with stakeholders to develop and implement a communication plan to provide Albertans with better information on CBM/NGC issues, including potential effects on water supply.
Review to Assess Progress	7.6.1	As recommendations in this document are implemented, it is recommended a multi-stakeholder committee be established by the Assistant Deputy Ministers Sponsors' Committee to conduct a review with the following components: ♦ Annual reviews for three years to assess progress according to a

Issue	#	Recommendation
		monitoring plan. • A second overall review in three years to assess: 1. The effectiveness of the recommendations, 2. New issues or information, and 3. An assessment as to whether additional recommendations may be needed.
Sufficient Resources	7.7.1	Appropriate government departments and agencies should have sufficient resources to be able to implement these recommendations effectively and efficiently.
Best Practices Manual		
	8.1.1	Industry, government and other stakeholders should work together to develop, document and implement best practices for CBM/NGC operations.
	8.1.2	Regulators should review CBM/NGC activities in other jurisdictions to ensure Alberta gains the benefit of studies and experience elsewhere, e.g., Report entitled: Coal Bed Methane Best Management Practices - A Handbook, Western Governors' Association, 2004.
Non CBM/NGC Specific Issues		
Short-term noise	9.2.1	Industry, regulators and other stakeholders should develop and communicate practices and procedures to deal quickly with short-term noise complaints that are not currently covered under the EUB's Guide 38.
Timing of Hearings	9.3.1	The EUB should continue to take into consideration the timing request of the surface rights holder/leaseholder during critical agricultural periods and not call a hearing at those times.
Notification of Sales Results	9.4.1	The DOE should review the full range of paper to electronic options of notification and should work with local government and other agencies to provide current P&NG sales data in a user-friendly format (including map format) to local and/or rural offices such as county offices, agricultural offices and public libraries.
	9.4.2	The DOE should provide instructions on its website on the process for conducting an information search by land or by mineral agreement.
Land Agents Accountability	9.5.1	The Alberta Government, including Human Resources and Employment, should expedite the industry initiative to improve the continuing education/certification of land agents, including periodic recertification, and if necessary, amend legislation to provide for same.
Wildlife	9.6.1	Industry should continue to consult with ASRD in consideration of minimizing disturbance to wildlife habitat and scheduling activities to address critical wildlife periods.
Caveats	9.7.1	The Government of Alberta should require Alberta Land Titles to ensure as much transparency of information as possible is included on certificates of title to mineral rights.

2.0 Introduction

2.1 Current Rules Apply

Natural gas in coal (NGC or coalbed methane (CBM)) is in the early stages of development in Alberta. In Alberta, CBM/NGC is subject to the same drilling, production and operational rules and regulations as natural gas development. The DOE, Alberta Sustainable Resource Development (ASRD) and the Alberta Energy and Utilities Board (EUB) have stringent rules and regulations in place for all natural gas development. If non-saline groundwater is encountered, Alberta Environment (AENV) regulates its diversion, use and disposal under the *Water Act*. In addition, there are identified 'best practices' associated with CBM/NGC development that industry is developing and will be encouraged to adopt.

The public indicated that there is a lack of Alberta-based information about the potential impacts associated with CBM/NGC, especially in light of activities in other jurisdictions. The Alberta Department of Energy (DOE) has initiated a review to determine if there are areas where the regulations and rules can be improved to handle any issues specifically associated with CBM/NGC. The ultimate objective is to ensure that the economic benefits for Albertans of CBM/NGC development are balanced with the protection of land, air and water resources. In its review, the government is looking at the experience of other jurisdictions, data collected from Alberta operations, and input from Albertans. The review has involved multi-stakeholder and public consultation through a variety of methods, including public information sessions across the province in the spring of 2004.

2.2 MAC's Role

The Coalbed Methane/Natural Gas in Coal Multi-Stakeholder Advisory Committee (MAC) was formed in November 2003 as part of the CBM/NGC review. The MAC is playing a key role in the review.

The purpose of the MAC is to:

- Guide the consultation process, including the development of a consultation framework to ensure issues are adequately addressed
- Determine the specific CBM/NGC issues to be addressed
- Coordinate, consolidate, evaluate and submit recommendations to the government

The DOE invited a broad range of sectors to nominate representatives to participate on the MAC, representing their respective organizations or sectors. The MAC includes representation from environmental organizations, surface rights and mineral rights holders, agriculture, local government, the energy industry and provincial government departments including the Department of Energy, Alberta Environment; Agriculture, Food and Rural Development; ASRD; and the EUB. (See Appendix A for a list of MAC members and their affiliations.)

The MAC's primary focus has been to gain an understanding of the issues related to CBM/NGC and to put forward recommendations to further ensure its responsible development in Alberta. Issue-specific working groups were formed from a cross-section of stakeholder organizations to study water, surface and air

issues related to CBM/NGC. Royalty and tenure issues were also reviewed by working groups set up by the DOE with new stakeholder participants selected by the MAC. The MAC has used the input from its working groups, public feedback and expert information to develop recommendations to present to the Alberta government.

The MAC is not addressing other issues or possible changes to Alberta's overall energy development philosophy, surface use compensation, or changes outside the responsibility and/or jurisdiction of the Alberta government. During the course of its deliberations, the MAC came across a number of out-of-scope issues. These issues will be referred to other organizations who deal with them directly or who have a review or consultation underway. The issues are listed in Appendix B.

2.3 About this Document

This preliminary findings document reflects input from the working groups as well as feedback from the public at a series of public information sessions held across the province in the spring of 2004.

The MAC found a number of issues unique to CBM/NGC development, primarily dealing with water. Other issues impact all oil and gas development, but may be intensified by CBM/NGC development, with its potential for a higher than average density of surface sites and associated cumulative impacts.

The document is divided into sections reflecting the main issues identified: Water, Surface/Air, Tenure and Royalties. Section 7.0 addresses broad issues that do not fit into those categories exclusively. Section 8.0 describes an independent but complementary initiative undertaken by industry to develop a best practices manual that includes a number of suggestions referenced in this document. Section 9.0 addresses broader issues that are not specific to CBM/NGC, but have been brought to the attention of the committee.

Each section begins with an introduction that describes the current situation as well as some of the related issues. After the introduction, the title boxes in the left-hand margin indicate the broad subject of the recommendations, while the boxed recommendations are intended to be more specific in nature. In most cases, a description of the issue, the current related regulations, and some discussion precede each recommendation.

The MAC achieved consensus on almost all the recommendations presented in this document. If consensus could not be reached on a specific recommendation, the discussion is noted in the text, but no recommendation was made. There was an exception with respect to the section on royalties. One organization informed the MAC that they were, as a matter of principle, unable to consider or support any reduction in the level of royalties for CBM/NGC production. The recommendations in this section were supported by all other members of the MAC.

Acknowledging that all the recommendations have priority and should be implemented as quickly as possible, the MAC has tentatively identified the top 10 recommendations that should be considered for early action.

The MAC is seeking public input on the recommendations before they are finalized. Members of the public, the original working groups and other stakeholders are invited to submit their comments and input by September 30, 2005. This document along with a comment form can be found on the DOE web site at http://www.energy.gov.ab.ca/245.asp.

The MAC will review and evaluate the comments for incorporation into a final report. Once the final report has been prepared, the MAC will submit it to the Assistant Deputy Ministers Sponsors' Committee in the fourth quarter of 2005 and it will be distributed to the appropriate government departments and agencies for consideration and response. The final report will be posted on the DOE web site.

3.0 Water

3.1 Introduction

CBM/NGC development in other jurisdictions has been associated with a range of production characteristics and impacts that have garnered public attention in the past few years. The potential for impact on groundwater has been a serious concern expressed in Alberta.

In Alberta, conventional gas development has not generally been associated with non-saline groundwater (groundwater with 4,000 milligrams per litre or less of total dissolved solids). Conventional gas production has occurred at depths where only saline water is normally encountered.

CBM/NGC differs from conventional gas development in the production of water. Where a coal zone is water saturated, a certain amount of water -- the exact quantity has not been established – needs to be withdrawn in order to depressurize the reservoir and start gas production. This may create potential impacts on water well users, since coal seams containing water are considered aquifers in their own right and may be used for water wells. CBM/NGC wells typically produce higher volumes of water with less gas during their initial production period, compared to conventional gas wells. The volume of water usually decreases over time, while the volume of gas increases.

About 90 percent of the 3,575 CBM/NGC wells drilled by year-end 2004 and about the same percentage of CBM/NGC wells with production in Alberta to that date have been in dry coal seams – Horseshoe Canyon/Belly River coals. In the areas where these dry coals are produced, they are extremely under-pressured and not expected to be connected to any underground water source. They essentially produce little or no water.

The remaining 335 CBM/NGC wells in Alberta are targeting seams that usually contain water. These coals are more normally pressured and may be wet – saturated with non-saline water – and are sometimes used as a source of water supply. The relatively deep Mannville coals (240 wells) are in seams containing saline water. Currently, to produce gas from these coals, the saline water is co-produced to depressurize the coals and increase gas production. This saline water must be disposed of in deep disposal zones and isolated from all non-saline water sources. The shallower Ardley coals (58 wells) have very limited production showing a range of producing characteristics containing no water, slightly saline water or non-saline water at different locations. Currently, most of these wells are shut in awaiting the outcome of the MAC process, further review by AENV and EUB, or authorization under the *Water Act*. (See Appendix C for CBM/NGC well activity and production.)

The MAC has concluded that the continuing protection of aquifers, water bodies and non-saline water users by the provincial government is critical for the appropriate development of CBM/NGC, especially in coal zones containing non-saline groundwater. The MAC found that the risk to non-saline groundwater from deeper saline CBM/NGC and intermediate dry CBM/NGC development was low, but additional care and study are still required.

In general the MAC agreed that in advance of significant growth of non-saline water producing wells, the existing regulatory framework should be reviewed to ensure that it adequately protects Alberta's non-saline water resources from any unreasonable impact associated with CBM/NGC. The MAC supports the province's water strategy, *Water for Life*, and a number of recommendations in this section support initiatives already underway through this strategy. A majority of the recommendations on water issues are specific to CBM/NGC development.

Some MAC members expressed the view that CBM/NGC development would have the least potential impact on Alberta's non-saline water resources if it continues on its existing path, targeting 'dry' coals first, followed by those in zones with saline water, and only at a later date, zones with non-saline water. The rationale with such a sequential approach would be that by the time non-saline coals were targeted for development, there would be improved technology and more scientific information available to minimize impact. Other MAC members did not want any development at all in non-saline coals, while others held the view that it was appropriate to develop non-saline coals now.

3.2 Improved Scientific Information

As CBM/NGC development proceeds, there is a need for more scientific information to help understand how to protect Alberta's water resources. A complete analysis and understanding of all the water supplies in the province would be the ultimate objective.

The need is especially important for improved groundwater data in CBM/NGC development areas where aquifers could be affected or where produced water could affect regional non-saline water supplies. Information should be available on the geological setting, groundwater quality/quantity and hydraulic connectivity. An inventory of groundwater has been started by AENV but is not complete.

Under existing rules, information is collected separately by AENV, EUB and others, primarily operators. The EUB and AENV have an informal process to share information. AENV has already established a water monitoring and data management system that could provide the basis for a more extensive and comprehensive program. The EUB also has its own data management system.

The Base of Groundwater Protection (BGWP) has been partially mapped across the province by AENV. This information is used to comply with the EUB's well drilling and completion requirements. The BGWP data is in an Excel spreadsheet and provides data on a township basis. The first release was in 1993, and an update was issued in 1995. The goal of the project is to provide either a reference well, or a depth below ground level for all townships, so that operators can easily determine the BGWP for a specific well. However, in some areas of the province, no data is available or only a formation has been identified. In this situation, the operator has to request a specific depth for the well in question. Limited resources have delayed the completion of the database and Alberta Geological Survey (AGS) has been contracted to finish the project and handle requests where data is not yet available.

The MAC determined that the development of CBM/NGC provides a timely opportunity to move these information-gathering projects ahead. This is

especially true if they are focused first in areas most likely to have CBM/NGC wells potentially producing from non-saline water aquifers or aquifers hydraulically connected to non-saline aquifers.

One issue discussed by the MAC was that there is insufficient information about groundwater recharge rates in areas that could experience intense CBM/NGC development. This information will be critical to guide decisions on diversions.

A second issue was the incomplete set of data to determine potential impacts to hydraulically connected aquifers by CBM/NGC development. To gain a better understanding of how hydraulically connected aquifers react, information should be collected and analyzed, again starting with areas that could experience intense CBM/NGC development.

The MAC further determined that CBM/NGC operators also have an important role to play to help maintain the province's supply of non-saline water by collecting and submitting baseline water-related data. This information will help further the province's knowledge and understanding of Alberta's aquifers. Surface rights holders should cooperate with industry in obtaining this data.

Recommendation 3.2.1
The following actions should be undertaken in collaboration with stakeholders to improve the scientific information on the province's water resources:

- AENV should expand its current monitoring network and data management system, beginning in areas that could experience intense CBM/NGC development.
- AENV should complete its inventory of groundwater in the province, beginning in areas that could experience intense CBM/NGC development. Coals containing non-saline water aquifers with potential CBM/NGC activity should be targeted. The inventory should include characteristics such as location, lateral extent, and porosity, as well as recharge rates and hydraulic connectivity between aquifers.
- The EUB and Alberta Geological Survey (AGS) should complete the Base of Groundwater Protection mapping project, beginning in areas that could experience intense CBM/NGC development.
- AENV and the EUB, together with industry, should investigate the potential for unintended effects of CBM/NGC development on surrounding aquifers.
- AENV should identify and characterize areas where CBM/NGC approval requirements need to be more rigorous due to potential impacts on non-saline aquifers, other water bodies and other water users. Maps of these areas should be made available to regulators, industry and stakeholders.
- Before drilling and production from a potentially non-saline aquifer where water volumes are anticipated to be above a threshold limit, CBM/NGC operators should obtain baseline data, including gas and mineral content and other indicators of water quality, flow rate/yield and water levels. In lower risk cases and below the threshold volume, less information may be required. The data would be included in a public database subject to confidentiality provisions.

3.3 Approval Process to Protect Aquifers and Water Supplies

Stakeholders have expressed concerns about the potential loss of good-quality groundwater and potential impacts on aquifers many kilometres away, even from CBM/NGC activity in dry coal seams.

Non-saline water diversion, use and disposal are administered by AENV, in accordance with the *Water Act*. The current Alberta Environment Guidelines for Groundwater Diversion for CBM/NGC Development (April 2004) are applied when produced water is expected to be non-saline. This would not include water condensation – the small amounts of non-saline water that come out of all natural gas as the pressure is reduced and the gas cooled.

A license is required for the diversion of non-saline groundwater (except for some exempted and household uses). To obtain a license, a preliminary groundwater assessment is required, including a field-verified survey of all existing water wells, springs and dugouts within a minimum 1.6 km radius of the proposed site, their normal flow rates/yield, and the purpose of the requested diversion. The field verified survey does not require qualitative or quantitative testing of the water wells.

The guidelines provide stringent requirements. The operator must submit evidence to demonstrate that the non-saline water diversion will not damage the source aquifer or other non-saline aquifers; will not impact local water supply; will not negatively impact the environment; and will be for a beneficial use.

Under Alberta's existing processes, the EUB also has a role in regulating some water aspects. The EUB regulates all produced water from CBM/NGC and other oil and gas activities, including the disposal of saline and non-saline produced water. The regulations address groundwater protection through requirements for well bore integrity (cemented casing through the zone of non-saline aquifers), and for the prevention of leaks and surface spills.

The EUB's legislation governing produced saline water requires that it be safely handled, stored and disposed by industry. Current EUB policy requires it be returned to below the BGWP. Disposal of produced saline water above the BGWP or on the surface of the land or surface water bodies is not allowed.

The MAC agreed that additional protection for non-saline aquifers could be provided by establishing appropriate production thresholds on both a well and an areal basis that would activate rigorous application requirements and processes.

The MAC also agreed that a more rigorous approval process may be unnecessary for developments with anticipated minimal impact on non-saline aquifers. In conjunction with the other non-saline water recommendations, a simpler approval process could be adopted for projects with non-saline water production below a minimum level.

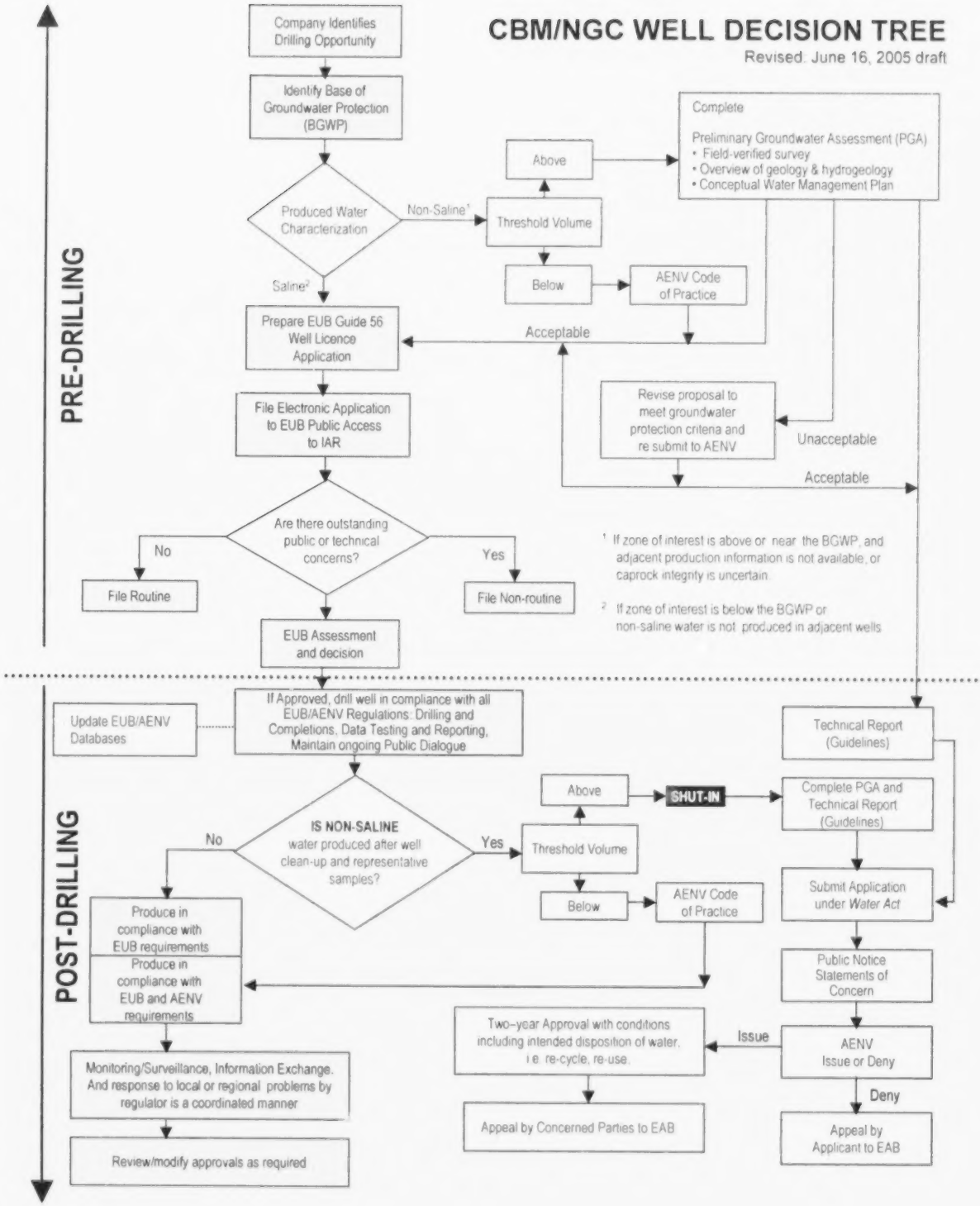
In this regard, the MAC discussed a few options. A subcommittee of the MAC suggested three volume levels, with the first level of one cubic metre (m^3) per month per well requiring limited approval, the second level from 1-30 m^3 per month per well requiring a more detailed process involving, for example, a 'Code of Practice', and volumes of 30 m^3 per month per well and above requiring more

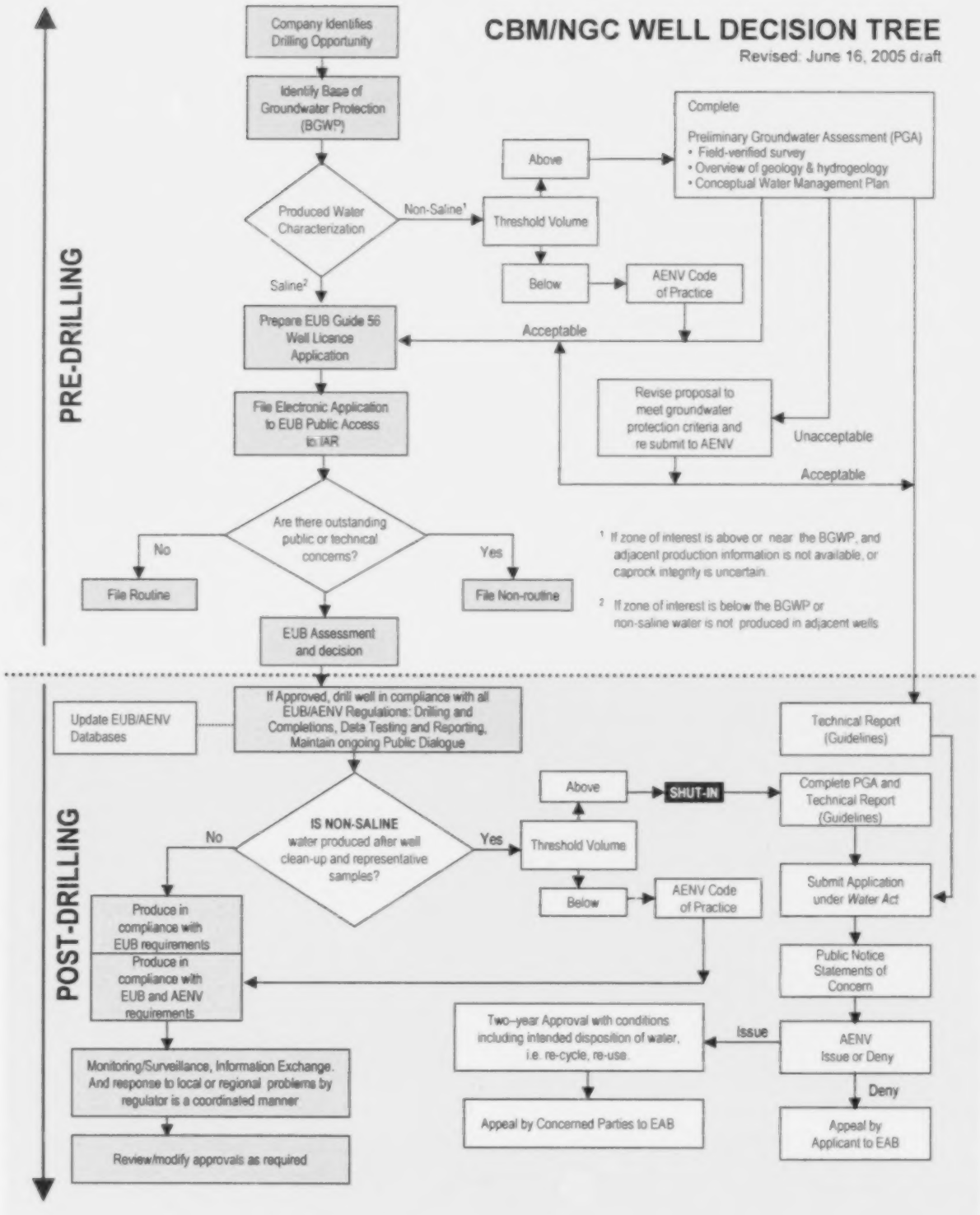
rigorous approvals. A threshold of 104 m^3 per month, the amount allowed for households, was also suggested. Another suggestion was a simplified process below 30 m^3 per well per month per section, a 'Code of Practice' for volumes between 30 and 100 m^3 per well per month per section and a risk-based 'decision tree' process for volumes over 100 m^3 per month per section. There was no consensus reached on any of these suggestions. The MAC agreed that a technical review is needed to determine an appropriate threshold number both on an individual well basis and an areal basis.

Recommendation 3.3.1
AENV should establish a multi-stakeholder technical committee to determine an appropriate, scientifically-based threshold for produced non-saline water below which a simplified approval under a Code of Practice for production or use of the water would apply. Threshold numbers should be developed for an individual well and on an areal basis. An interim threshold number should be determined and applied by AENV until the committee completes its work. AENV should also establish a Code of Practice with stakeholder input.

The MAC supports strengthening the approval process for CBM/NGC to ensure the protection of aquifers and non-saline water supplies. A risk-based approach would target developments with the most significant potential impacts. The greater the risk of effects on aquifers, the greater the need is for the technical report which discusses the hydrogeological and environmental information and impact assessment as required by the AENV Guidelines for Groundwater Diversion for Coalbed Methane/Natural Gas in Coal Development (April 2004).

The following 'decision tree' is a draft concept, but outlines a possible process to identify and address concerns. It clearly identifies the actions operators would be required to take at every step, and situations where CBM/NGC development would not be allowed due to identified risk. It will provide for the gradual development of non-saline CBM/NGC activity, and allow for the gathering of scientific information to help guide activities in the future.


CBM/NGC WELL DECISION TREE
Revised. June 16, 2005 draft
PRE-DRILLING
Company Identifies Drilling Opportunity
Identify Base of Groundwater Protection (BGWP)
Produced Water Characterization
Non-Saline[1]
Saline[2]
Above
Threshold Volume
Below
Complete
Preliminary Groundwater Assessment (PGA)
• Field-verified survey
• Overview of geology & hydrogeology
• Conceptual Water Management Plan
AENV Code of Practice
Prepare EUB Guide 56 Well Licence Application
Acceptable
Revise proposal to meet groundwater protection criteria and re submit to AENV
Unacceptable
Acceptable
File Electronic Application to EUB Public Access to IAR
Are there outstanding public or technical concerns?
No
Yes
File Routine
File Non-routine
EUB Assessment and decision
[1] If zone of interest is above or near the BGWP, and adjacent production information is not available, or caprock integrity is uncertain.
[2] If zone of interest is below the BGWP or non-saline water is not produced in adjacent wells
POST-DRILLING
Update EUB/AENV Databases
If Approved, drill well in compliance with all EUB/AENV Regulations: Drilling and Completions, Data Testing and Reporting, Maintain ongoing Public Dialogue
Technical Report (Guidelines)
IS NON-SALINE water produced after well clean-up and representative samples?
No
Yes
Above
SHUT-IN
Threshold Volume
Below
AENV Code of Practice
Complete PGA and Technical Report (Guidelines)
Submit Application under Water Act
Public Notice Statements of Concern
Produce in compliance with EUB requirements
Produce in compliance with EUB and AENV requirements
Two-year Approval with conditions including intended disposition of water, i.e. re-cycle, re-use.
Issue
AENV Issue or Deny
Deny
Appeal by Concerned Parties to EAB
Appeal by Applicant to EAB
Monitoring/Surveillance, Information Exchange. And response to local or regional problems by regulator is a coordinated manner
Review/modify approvals as required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File Non-routine
EUB Assessment and decision
[1] If zone of interest is above or near the BGWP, and adjacent production information is not available, or caprock integrity is uncertain.
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If Approved, drill well in compliance with all EUB/AENV Regulations: Drilling and Completions, Data Testing and Reporting, Maintain ongoing Public Dialogue
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Complete PGA and Technical Report (Guidelines)
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Submit Application under Water Act
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Produce in compliance with EUB requirements
Produce in compliance with EUB and AENV requirements
Two–year Approval with conditions including intended disposition of water, i.e. re-cycle, re-use.
Issue
AENV Issue or Deny
Deny
Monitoring/Surveillance, Information Exchange. And response to local or regional problems by regulator is a coordinated manner
Appeal by Concerned Parties to EAB
Appeal by Applicant to EAB
Review/modify approvals as required

Recommendation 3.3.2
AENV and the EUB should develop a 'decision tree' approach for reviewing CBM/NGC applications involving non-saline water production. This process should address the level of risk to aquifers and users by considering factors such as hydrogeological settings, existing users, salinity and expected volumes of water produced. The decision tree should be developed with stakeholder input and should:

- Incorporate the threshold volume of produced non-saline water, below which the Code of Practice would apply (See Recommendation 3.3.1).
- Consider geographical areas where the risk to the quality or quantity of water supplies might be greater than in other areas. It will be critical to know and understand those areas that may require special or additional attention from AENV. (See Recommendation 3.2.1).
- Ensure that applications for CBM/NGC wells that would produce volumes of non-saline water in excess of threshold volumes trigger accelerated aquifer studies.
- Ensure appropriate compliance with the decision tree.

There is some limited activity in saline water producing coals, but not enough to indicate how the various coals can best be developed with the least possible impact. More activity could help provide this useful information. (A proposal for assistance in developing saline water producing coals appears in the Royalties Section 5.0.)

The MAC indicated that the existing AENV guidelines should be reviewed and enhanced to ensure the principles of protecting aquifers are clear and that minimum approval conditions are consistent across the province. This should not limit additional conditions being specified in certain situations.

Recommendation 3.3.3
AENV's Guidelines for Groundwater Diversion for CBM/NGC Development (April 2004) should be enhanced and required for a single well or group of wells where non-saline water is present or anticipated.

- The guidelines should be reflected in the risk-based 'decision tree' process.
- To ensure consistency, minimum conditions for approvals should be standardized across the province, with additional site-specific conditions possible.
- The components of the field-verified survey of all water sources should be reviewed to ensure their appropriateness and effectiveness with regard to the scale of the project.
- A province-wide review of existing CBM/NGC wells should be undertaken to ensure all guidelines have been met.

Some stakeholders stated that the existing rules to protect non-saline aquifers were not sufficiently well known by most Albertans, and even some industry members. Under the existing rules, water levels are not allowed to drop below the top of a non-saline aquifer while water is being produced from an energy or a water well. The drawdown is permitted to the top of the aquifer. The amount of drawdown varies according to the type of aquifer and the location of the well in the aquifer, etc. but the top of that aquifer is not always identifiable. This practice

is science-based and recognized in sustainable resources management. The MAC agreed that these rules and their application to CBM/NGC should be clarified.

Recommendation 3.3.4
AENV should clarify and communicate the existing rules regarding how much drawdown is allowed during CBM/NGC depressurization in a confined non-saline aquifer to ensure aquifer protection.

The MAC determined that standard procedures for sampling and analyzing water from both energy and water wells are needed in order to provide meaningful, useful and consistent data.

Recommendation 3.3.5
AENV and the EUB should work with stakeholders, including the environmental service industry, to develop standard procedures and reporting requirements for the sampling, analysis and monitoring of both saline and non-saline water quality and quantity for CBM/NGC wells and potentially affected non-saline water wells. Quality assurance and quality control measures should be developed, as well as a range of tests, depending on the type of water being tested, including:

- Testing for a variety of metals and other impurities, as well as total dissolved solids.
- Testing for the presence of gas in water wells. The presence or lack of gas should be included on the water analysis report or file. (See Section 3.6 for discussion on methane migration and release).
- Non-saline water produced from coal seams should be tested for its intended use or to determine what it can be used for.

Some MAC members expressed concerns about household water wells and possible contamination from CBM/NGC operations. Industry has adopted water well testing as a best practice, but there is inconsistency in its application and no requirement by any regulatory body for water well testing. The EUB strongly encourages, but does not require, water well testing. The EUB recommends operators identify water wells and offer to test them whenever they are drilling oil and gas wells nearby.

Water well testing is a recurring issue for many surface rights holders that sometimes requires appropriate dispute resolution, even though operators are encouraged by the EUB to attempt to resolve issues with the surface rights holder.

Some MAC members wanted water well testing to be a requirement. They requested that the MAC consider a recommendation that all water wells within a 880 m radius of the proposed CBM/NGC well be tested before the CBM/NGC well is drilled, since there may exist a greater potential for methane migration with CBM/NGC wells compared to conventional wells. Wells should be tested for water quality, flow rate/yield and methane. This proposed recommendation did not achieve consensus. Neither was consensus achieved for a proposed recommendation by other MAC members to test water wells within 800 m of

CBM/NGC wells completed above the BGWP and expected to produce non-saline water based on evidence from other wells in the area.

Some stakeholders raised specific issues regarding drilling and completion practices for water and for energy wells, including drilling and completion fluids, well bore integrity and aquifer isolation, casing types, types of completion, and well operations and maintenance practices.

There are regulations, directives, guidelines and practices accepted by regulators regarding drilling and production practices of both water and energy wells. (See Appendix D.)

The MAC considers that there is a responsibility on the part of both operators and surface rights holders to ensure that their practices have the least impact on water supplies and aquifers. The MAC determined that these areas are currently regulated in detail, but a further technical review by experts in each field will ensure that the regulations provide consistent protection and incorporate the best available practices.

Recommendation 3.3.6
AENV and the EUB should review drilling and completion practices for new and recompleted water and energy wells, ensuring regulations are appropriate for the purpose of the well. Topics to be addressed should include: drilling and completion fluids; well bore integrity/aquifer isolation; casing types; and completions, etc. This review should include the drilling and abandonment of temporary water source wells.

3.4 Drilling Fluids

The drilling of any well, including water wells and CBM/NGC wells, involves the use of drilling fluids that provide lubrication and sealing as the well bore is drilled. Stakeholders wondered whether the use of untreated water from dugouts, sloughs or other such water bodies as a drilling fluid could introduce foreign substances such as bacteria into shallow aquifers. This issue is not specifically related to CBM/NGC drilling.

The *Environmental Protection and Enhancement Act* (EPEA) advises that no person shall release a substance into the environment that causes or may cause a significant adverse effect. The Water (Ministerial) Regulation instructs water well drillers not to use fluids or substances during drilling operations that may cause an adverse effect on the environment, human health, property or public safety. AENV currently specifies that water withdrawn from a water body should be disinfected (treated) prior to being used to drill water wells. Chlorinated water is an example of treated water.

There was discussion by the MAC about the possibility of immediately restricting all CBM/NGC well drillers to using drinking quality or treated water for drilling. The potential decrease in risk of bacteria being introduced into a well given various aquifer conditions was considered. As well, the potential impacts of requiring drinking quality water to be used for drilling in areas where agriculture users and municipalities are short of water were considered. No consensus was reached on whether immediate changes should be recommended.

The MAC heard from the EUB that there is no scientific evidence to demonstrate that current Alberta drilling fluid practices result in groundwater contamination. Some MAC members believed that there was not enough information to prove it one way or the other. The MAC agreed that the following recommendations should be adopted as a precautionary measure.

Recommendation 3.4.1
The EUB and AENV should communicate with CBM/NGC operators, drilling contractors and water well drillers regarding current and future requirements to protect non-saline aquifers. Action should be taken if there is evidence that an existing well has not met AENV's Guidelines for Groundwater Diversion for CBM/NGC Development (April 2004) (recommended for revision in Recommendation 3.3.3). Any company producing non-saline water from a CBM/NCG well without authority for a diversion above the threshold volumes should immediately stop operations and notify provincial regulators to initiate the authorization process.

Recommendation 3.4.2
The EUB and AENV should, in cooperation with other organizations such as the Alberta Research Council, investigate whether CBM/NGC drilling and completion practices such as using dugout water and untreated river water may affect aquifers, and review regulations to determine whether changes are needed. They should also consolidate and review studies regarding drilling and completion fluid constituents and their potential for deleterious effects.

3.5 Promoting the Wise Use and Conservation of Water

As surface water becomes scarce in some basins in the province, non-saline groundwater will become increasingly important, and CBM/NGC has the potential for increased water production, compared to conventional gas. Therefore, protecting the water wells, water supply and aquifers in the province is paramount, and conservation should be practiced wherever possible. This philosophy, expressed by many Albertans across the province, is potentially in conflict with the current practice of deep-well disposal of non-saline water produced from CBM/NGC activities.

The MAC, after reviewing the issues and considering the experience in other jurisdictions regarding the use of non-saline water for agriculture, came to agreement that the use of non-saline produced water for other applications should be encouraged, as long as there is minimal risk or perceived risk to land and animals. The use of non-saline produced water would be most desirable, followed by returning the water to its original aquifer or a lower quality aquifer. Deep well disposal should only be considered in the absence of any other viable option. The MAC agreed that it is important to establish policy and rules on produced water conservation – before significant non-saline water production occurs.

The MAC further considered it feasible that CBM/NGC development might create new sources of water for other industrial applications in the area. Some operations that use water may be able to switch to a lower quality water source.

The MAC agreed that regulators should require adjacent industrial projects using non-saline water to review their water source if new sources of lower quality water become available. Also, if an injection operation requires additional water, then new alternate sources of lower quality water must be considered.

Recommendation 3.5.1
AENV and the EUB, with stakeholder input, should:

- Review existing requirements for deep well disposal of non-saline produced water and consider alternatives, if appropriate.
- Establish criteria for the beneficial use of non-saline produced water.
- Develop guidelines, including a requirement for a beneficial use assessment for non-saline produced water and include them in the decision-tree approval process.
- Revisit authorized diversions of non-saline groundwater for industrial use when CBM/NGC developments create new sources of water in the area.

The MAC also agreed that the potential for treatment and use of water that is somewhat above 4,000 milligrams per litre of total dissolved solids should be investigated. In the future, marginally usable waters may become more valuable, particularly in fully allocated basins. Pending the results of this investigation, AENV and the EUB should review situations where saline and marginally saline water have a reasonable potential for re-use, such as oilfield injection. The strategy of treating and re-using produced water should be adopted with sound technical guidelines and concern for safety.

Recommendation 3.5.2
AENV and the EUB, with stakeholder input, should establish criteria for the beneficial use of marginally saline produced water. AENV and the EUB, with stakeholder input, should then develop guidelines, including a requirement for a beneficial use assessment for marginally saline produced water, and include them in the decision-tree approval process.

Recommendation 3.5.3
AENV, the EUB and the DOE should work with the water producing and environmental services industries to promote the development of new technology or the application of existing technology that can take advantage of saline and marginally saline produced water.

3.6 Methane Migration and Release

Some aquifers naturally contain methane and some water wells already produce associated methane. However, the public wants to be satisfied that methane will not migrate into local water supplies as a result of CBM/NGC development.

The process of depressurization of coal seams through water production liberates methane. If a water well is completed in a hydraulically connected aquifer, then depressurization could lead to a greater potential for methane release into the water well. Methane migration should not occur within the same aquifer if the pressure of the energy well is lower than water wells in the aquifer.

Some MAC members noted that this is not an issue in already underpressured dry coal zones, since aquifers would only be hydraulically connected if water is present in the coal zone. It was also noted that production from most deep saline CBM/NGC wells would not affect shallower aquifers that serve as non-saline water sources for Albertans.

AENV currently requires wells producing non-saline water not unreasonably interfere with any active water well in the vicinity. Such interference might include: decreasing flow, introducing foreign substances, and increasing the amount of methane, if any, that would be produced from the water well.

The MAC determined that the effects of depressurization need to be more clearly understood and negative impacts on water well users prevented. Any study on this issue should include: a review of relevant literature; the development of a sampling program with objectives and potential outcomes; the development of tracking methods such as isotopic and geochemical indicators; as well as 'pressure front' tracking. In addition, numerical simulation of potential vertical/horizontal flow should be included.

Recommendation 3.6.1
AENV and the EUB should work with industry to investigate the potential for methane migration or release to water wells as a result of CBM/NGC depressurization.

The MAC also agreed that once baseline data is available, as indicated in Recommendation 3.2.1, it should be possible to develop measures to reduce the likelihood of methane migration.

Recommendation 3.6.2
Based on the results of the previous recommendation, AENV and the EUB should implement appropriate prevention, monitoring and mitigation measures to address methane migration or release, if necessary.

4.0 Surface/Air

4.1 Introduction

Individual CBM/NGC wells in Alberta will vary significantly in size and equipment, depending upon whether they are 'dry' or 'wet' and whether they are evaluation or development wells.

The most abundant dry CBM/NGC wells have a smaller, lighter footprint than most other types of energy developments, similar to conventional shallow gas. These wells are usually drilled using 'minimal disturbance' techniques that do not remove the topsoil. When on production, this type of well only requires a small fenced area around the wellhead (typically 3 m x 3 m) and no developed road. Most of these wells are not accessed very often after initial drilling and completion and many can be monitored without driving onto the site. When these wells are in the early evaluation phase (pre-development) or when a low-pressure gathering system is not accessible, a larger footprint is required for an individual wellsite compressor. In most cases, this is not a permanent operating configuration, but some wells have been tested in this fashion for several months or more.

When CBM/NGC wells are wet and must produce water to produce gas, the footprint is larger. Many of these wells cannot be drilled using minimal disturbance methods and a larger location is required to handle the pumping equipment and, in some cases, wellsite tanks. Since most of these wells are currently in the evaluation phase, the produced water must be pumped out and piped or trucked away, possibly requiring a permanent road and other equipment, creating more surface impact than dry wells. At these temporary sites there may also be some wellsite compression. If successful, development wells would likely use less wellsite equipment (tanks, compressor) and the water would be collected and disposed of at a central facility, where compression would also occur.

For both dry and wet developments, a central compression facility will add to the cumulative project footprint. In typical dry developments, there is one facility per township (36 sections). Where existing compressor stations are being used, they may be expanded onsite, or additional booster sites may be added, further increasing the footprint. Although no successful wet development facilities are in operation today (only evaluation or pilot wells), additional equipment would be required for water separation, storage and disposal during the development stage.

For both wet and dry wells, directional, horizontal, and pad drilling techniques may be employed in some cases to reduce the cumulative surface imprint. A number of wells, both wet and dry, have been drilled in this manner and evaluation is ongoing to determine the optimal approach in different areas.

The pace of CBM/NGC development and the projections for significantly more wells over a broad land base of Alberta have resulted in members of the public bringing forward a variety of issues related to surface and air impacts.

While there are no surface or air issues that are specific or unique to CBM/NGC, the issues identified in this section may be intensified by growing CBM/NGC development.

Currently, surface and air impacts for CBM/NGC development are addressed through the following legislation:

- The *Environmental Protection and Enhancement Act* (EPEA) administered by AENV takes an integrated approach to the protection of air, land and water. EPEA contains numerous provisions regarding the release of substances into the environment and, for certain defined activities, an approval must be obtained from AENV.
- Under the *Energy Resources Conservation Act*, the EUB is required to review proposals for energy projects to ensure they are in the public interest, and have considered social, economic and environmental impacts. The EUB regulates the drilling, completion, operation and abandonment of all oil and gas wells.
- The Alberta Government uses a variety of legislation and management mechanisms to maintain the environmental integrity of public lands, while specifying the different levels and types of allowable use.

(See Appendix D for further description of relevant legislation.)

A particular concern expressed by some stakeholders was regarding activity in new areas not accustomed or suited to the pace, scale and density of CBM/NGC development. Future CBM/NGC development will likely occur in some areas that have had limited energy development to date, as well as in areas with larger and growing populations, and lands with special environmental, recreational or other sensitivities.

Some members of the public were concerned that CBM/NGC applications could result in surface locations of potentially 36 wells per section per pool. With an inter-well distance of 200 metres, and the calculated potential for nine wells per quarter section, the 36 well figure was extrapolated. Experience to date suggests that CBM/NGC development may require between one and eight wells per section per pool (or for a number of commingled pools together) for subsurface drainage and pressure depletion. This number is comparable to conventional oil well density and is lower than heavy oil well density.

The EUB has indicated that to clarify this matter, all reduced spacing holding approvals will now contain a clause specifying well density, and there is a plan to review existing approvals to ensure the clause is present, where appropriate.

While the EUB has so far identified over 100 CBM/NGC multi-well pools and over 52,000 conventional oil and gas pools throughout the province, the definition and areal extent of individual gas pools and their relationship with the potential number of surface well sites are not generally known by surface rights holders and others.

The MAC supported the right of surface rights holders to a quiet enjoyment of their land, although that right must be balanced with the right of industry to produce oil and gas, the right of present and future Albertans to a clean and safe

environment, and the benefit received by all Albertans from royalties, taxes and employment from energy development.

The MAC determined that CBM/NGC and other oil and gas operators should make a reasonable effort to mitigate activities that cause visibility issues, noise, traffic and dust, etc. Surface rights holders with their own land management objectives should be more informed about possible options for a surface location and ways to address other concerns. A Best Practices Manual (Section 8.0) will help address this gap.

Because CBM/NGC involves sweet, lean (no heavier hydrocarbon components) natural gas, there are fewer emissions than with oil, more hydrocarbon rich gas, or sour gas developments. Venting is not permitted by the EUB except in cases where the gas is not able to support stable combustion. This may occur when the gas flow rates are very low or intermittent or when the extracted gas cannot be ignited due to insufficient energy content. Low energy content can result from high levels of nitrogen being flowed back after nitrogen fracturing operations. In these cases, the gas may be vented initially but must be flared once it is capable of supporting combustion.

The topic of flaring and venting of CBM/NGC wells was referred to the Clean Air Strategic Alliance (CASA), a nonprofit association composed of stakeholders from three sectors – government, industry and non-government organizations such as health and environment groups. CASA's experienced Flaring and Venting Project Team reviewed all related information and established flaring and venting criteria for CBM/NGC wells. (See Appendix E for a copy of the CASA report.)

The MAC reviewed a number of issues dealing with potential production of water and drilling practices (Section 3.0). It recommended two approaches that relate to both surface and water: increased planning and notification, and the documentation and use of best practices by industry. These recommendations are addressed in Section 7.0 and Section 8.0, respectively. The key recommendations that impact surface issues are repeated here.

Recommendation 7.2.1
The EUB and AENV should work with stakeholders to review the application processes for intense CBM/NGC developments to enhance and promote project-based planning and disclosure. This would allow:

- Definition of intense project developments
- Full project disclosure
- Improved community consultation
- Enhanced impact assessment
- Review of mitigation measures

Recommendation 8.1.1
Industry, government and other stakeholders should work together to develop, document and implement best practices for CBM/NGC operations.

4.2 Land Management to Address Cumulative Impacts

Members of the public questioned whether continuing growth of CBM/NGC would bring an increasing number of wellsites, roads, pipelines, compressors and other equipment and their associated cumulative impact on private and public lands.

The Alberta Government's Integrated Land Management initiative will be a major implementation mechanism for the provincial Land Use Framework. The initiative includes a set of basic integrated land and resource management process principles that support a framework of operational planning, informed decision-making and land management tools. It will concentrate on public land and associated resources with a focus on managing the overall footprint, including industrial development and recreational activity.

Under existing rules, the EUB expects operators to coordinate development with other companies to minimize potential impacts. The EUB has specific requirements to address the proliferation of larger impact developments, such as sulphur recovery gas plants. The EUB also has legislative authority to declare common facilities and pipelines and to ultimately force sharing and cooperation. For smaller scale developments, the EUB can require additional reviews and condition or deny applications when options to reduce impacts have not been pursued. Surface rights holders also currently play a role in reducing surface impact, for example, by requesting companies use existing infrastructure.

The MAC agreed that land management planning, strategies and tools are required of both government and landowners to proactively maintain the land's usefulness and productivity. That concept is included in Section 7.0 as well as in the following recommendation.

Recommendation 4.2.1
The EUB should review its regulatory process for ways to support minimal surface disturbance and reduced cumulative impact associated with CBM/NGC development.

4.3 Protecting the Environment

A healthy environment is critical to the quality of life for humans and wildlife. It provides ecological value, including watershed protection, healthy air, habitat diversity, natural vistas and recreational opportunities.

Under existing rules there are processes for identifying sensitive ecological and wildlife areas and operating conditions to minimize the effects of development. An example of such a process is the Natural Areas Program administered by Alberta Community Development that designates certain areas with special or sensitive natural landscapes or features for low-intensity recreation, nature appreciation and education. Some areas of the province have been identified by ASRD and AENV as requiring expanded assessments or additional development controls. The EUB has also recognized some sensitive areas in the province, such as the East Slopes, Zama-Hay Lakes and native grasslands, which trigger increased regulatory requirements and a higher level of assessment and cooperation.

The MAC considered the potential impact of additional CBM/NGC activity. Although CBM/NGC wells can be low impact individually compared to other oil and gas activity, there is the potential for significantly increased well density and infrastructure, and additional traffic for equipment maintenance. In such cases, CBM/NGC development may significantly affect the benefits and opportunities of a healthy environment in some areas.

The MAC determined that there should be an additional effort to identify sensitive areas that may be particularly impacted by CBM/NGC development.

Recommendation 4.3.1
To protect the environment and minimize the cumulative impacts from CBM/NGC development, a government-led multi-stakeholder committee, such as that being set up under ASRD's Integrated Land Management Program if appropriate, should undertake the following sequentially:

1. Review integrated land management principles, policies and practices relating to CBM/NGC to ensure they maintain the integrity and function of the land, taking into account all uses.
2. Identify environmentally sensitive and threatened areas (including areas not already designated) that are not appropriate for CBM/NGC development.
3. Recommend needed baseline studies to identify any areas where the integrated land management process may not adequately protect environmentally sensitive areas from the impacts of CMB/NGC development and make appropriate recommendations for the protection of these areas, taking into account all uses.
4. Provide any such recommendations or data gathered from baseline studies to the appropriate existing program/group for consideration and/or implementation in their process.

The MAC also discussed the need for the science of remediation and/or reclamation to be improved. It considered the potential for reducing impact on existing and future potential CBM/NGC sites, as well as the potential for creating other opportunities that would otherwise not be available due to potential for negative impact. It was considered that an enhanced ability to remediate and to reclaim presented benefits for CBM/NGC producers, surface rights holders, various public groups, other industries, and Albertans in general.

Recommendation 4.3.2
Government and all relevant industries should work together to improve the science and technology for remediation and reclamation of the land in sensitive areas that could be impacted by CBM/NGC development.

5.0 Royalties

5.1 Introduction

The Alberta Geological Survey (AGS) estimates that there is about 514 trillion cubic feet (Tcf) of CBM/NGC in place in Alberta – almost double the known conventional gas in place currently booked for Alberta. AGS maps indicate a CBM/NGC resource potential of 57 Tcf in the Ardley, 71 Tcf in Horseshoe Canyon, 147 Tcf in Belly River and 239 Tcf in Mannville coal formations. The recoverable amount of this resource has not yet been determined.

The MAC reviewed the formations noted above. The coal formations that have attracted the most development to date from CBM/NGC operators have been the Horseshoe Canyon/Belly River and the Mannville. The Horseshoe Canyon/Belly River is predominantly shallow and dry, while the Mannville is deeper and is generally associated with large volumes of saline water. Although exploration activity began in both formations at roughly the same time, the Horseshoe Canyon/Belly River is the only coal seam where significant commercial development of CBM/NGC is taking place. There has been very limited development in the Ardley formation to date, although it is a future area of potential for non-saline CBM/NGC development.

All natural gas in Crown lands attracts royalties under the Natural Gas Royalty Regulation, 2002, regardless of the mineral source. Royalties are based on a number of specific business and economic principles. These principles are stated as follows:

- Albertans receive a fair share for the development of their resources;
- Alberta has the appropriate natural gas royalty regime in place for the responsible development of all sources of natural gas; and,
- Investors and developers receive appropriate reward and recognition for risks and uncertainty taken in developing the resource.

On about 19 per cent of Alberta's lands, mineral rights are held by the federal Crown within national parks and Aboriginal lands, by the national railway companies, by the successors in title to the Hudson's Bay Company and by the descendants of homesteaders through rights granted by the federal Crown before 1887. The people of Alberta receive benefits through payment of mineral tax by companies who are undertaking oil or gas development on freehold land under provincial jurisdiction. A higher percentage of checkerboard-patterned ownership of Crown and freehold mineral rights is located in potential CBM/NGC development areas in the southeast quadrant of Alberta.

The MAC reviewed the economics of CBM/NGC development to date, along with as much information as could be obtained on future potential development. In general, the MAC concluded that, based on the great similarity to other shallow gas wells in southeastern Alberta, the royalties currently applied to the Horseshoe Canyon/Belly River and other dry CBM/NGC developments appeared to be appropriate to the resource. Further, the MAC considered the difficulty in distinguishing between coal and sandstone sourced gas from the same well

perforated in rock columns that are a mix of both and determined it would be impractical to try to differentiate between the two sources for royalty purposes.

One organization informed the MAC that they were, as a matter of principle, unable to consider or support any reduction in the level of royalties for CBM/NGC production. The recommendations in this section were supported by all other members of the MAC.

5.2 Information on Mannville Coals

CBM/NGC operators have suggested that the cost of producing natural gas from water-bearing coal seams such as the Mannville is higher than the cost of other natural gas development. Industry has requested royalty acknowledgement of the additional associated costs of water handling and disposal related to CBM/NGC development.

The results of the economic analysis completed for the Mannville formations during this review were not conclusive. There is no clear-cut determination that this formation is or is not economically viable based on the current level of understanding. Without further drilling, many of the key parameters are still uncertain. However, some form of fiscal recognition appears reasonable to promote the drilling of more wells to acquire better knowledge of deep saline wet coal. In this context, CBM/NGC operators pointed to Alberta's past successes in encouraging the development of horizontal wells, oil sands, deep gas, and enhanced oil recovery.

The following recommendation, while it targets only the Mannville formation, is being put forward with the understanding that the recommendations to protect Alberta's non-saline water resources will be implemented. The spirit of the recommendation is to create a balance between providing some incentive to industry to gain information, while ensuring that development does not occur too rapidly.

Recommendation 5.2.1
The DOE in consultation with stakeholders should determine an appropriate level of royalty reduction for a period of up to five years to encourage the drilling of saline CBM/NGC wells in the Mannville formation for the purposes of acquiring information. This pilot-type program would provide and make public data on the economics, geological and technical aspects of drilling in formations with saline water, with data aggregated in cases where competitiveness would be jeopardized.

The MAC also acknowledged that CBM/NGC development is not unique to Alberta, and therefore Alberta's royalties should not have to shoulder the entire burden of fiscal assistance to the industry. Other regions with CBM/NGC potential include British Columbia, Saskatchewan, Ontario, Nova Scotia, the Northwest Territories, Nunavit and the Yukon. Since the information gained from drilling in the Mannville formation would benefit these other regions, the federal government should also contribute to a fiscal program for developers.

In the United States, early development of CBM/NGC was assisted by a credit against federal income tax. British Columbia has already implemented a fiscal program to encourage CBM/NGC development. Alberta has consistently applied the existing gas royalty structure to all CBM/NGC wells and no changes have yet been made.

Recommendation 5.2.2
The Alberta and the federal governments should consider recognizing Canada's CBM/NGC potential through the adjustment of tax regimes, including corporate income tax and freehold mineral tax, to encourage a five-year pilot-type drilling program for saline CBM/NGC wells in the Mannville formation for the purposes of acquiring information.

A royalty reduction program was also proposed to encourage the use of directional drilling and other technologies that reduce surface impact associated with shallow CBM/NGC activity and to promote the development of new technologies. This program was proposed to apply to other low productivity gas, not just CBM/NGC, and companies would not be able to take advantage of both royalty reduction programs simultaneously.

The MAC considered the potential benefit of reducing surface impact, and the potential financial risk to surface holders who receive income from a number of surface location and road leases. No consensus was reached on supporting the recommendation for a technology-related royalty reduction, with some members indicating that this was not an appropriate area for the government to spend taxpayers' dollars.

A further suggestion related to providing a royalty incentive for using saline rather than non-saline water for industrial uses such as enhanced oil recovery. This might aid in the more rapid development of saline water applications, and help protect and conserve the province's non-saline water resources.

Recommendation 5.2.3
The DOE in consultation with stakeholders should consider the use of appropriate fiscal tools to encourage the use of saline water from CBM/NGC development to replace non-saline water for enhanced oil recovery and other industrial uses.

6.0 Tenure

6.1 Introduction

Tenure is the process by which companies are granted the right to explore for and develop oil and gas resources, in exchange for the value to Albertans, as owners of the resource, which flows from development in the form of royalties, bonus bid payments and rents.

The provincial Crown owns approximately 81 per cent of Alberta's mineral rights, which are managed by the DOE. The remaining 19 percent are owned as 'freehold' rights. Freehold mineral rights are held by the federal Crown within national parks and Aboriginal lands, by the national railway companies, by the successors in title to the Hudson's Bay Company and by the descendants of homesteaders through rights granted by the federal Crown before 1887. The result has been a checkerboard pattern of Crown and freehold rights in some parts of the province.

A company or individual wishing to acquire oil and gas rights can ask the DOE to make them available at a sale either through a license or a lease. Minimum and maximum areas are determined for the license or lease, depending on the region and the type of agreement.

After ensuring the requested rights are available for disposition, the DOE refers the request to the Crown Mineral Disposition Review Committee, which identifies any surface access restrictions before the sale takes place.

The MAC believes the existing tenure system can adequately accommodate CBM/NGC, although some changes could promote more orderly development. Two main tenure issues were identified in relation to CBM/NGC: ownership of CBM/NGC and administration of Crown agreements. The DOE will need to assess the overall impact of the recommendations on the industry, and in some cases undertake broader industry and stakeholder discussions through normal consultation processes, since tenure rules would ultimately apply to all conventional and unconventional oil and gas exploration and development.

6.2 Ownership Issues

On lands where the Crown owns all the minerals, the rights to CBM/NGC are acquired and belong to the owner of a petroleum and natural gas (PN&G) agreement. According to the *Mines and Minerals Act* (Section 67(2)), which applies only when the Crown owns the mineral rights, coal lessees do not have the right to recover natural gas from coal except for safety and conservation reasons. Where ownership is split, e.g., the Crown owns the coal rights and the P&NG rights are freehold, or vice versa, or two separate freehold owners exist, it is not clear who has ownership of the CBM/NGC.

There is currently no formal process to resolve this kind of issue. Conflicting owners may negotiate or ultimately look to the courts to resolve this issue. Freehold owners may not be aware of the potential significant risks related to this issue. Industry could also benefit from additional awareness about split ownership.

Ownership issues may also apply to in-situ coal gasification. During in-situ coal gasification, coal is converted to gas by burning part of the coal underground. Extracted gases can be used as fuel or chemical feedstock.

While CBM/NGC takes advantage of natural gas that would otherwise not be produced but leaves the coal intact, in-situ coal gasification requires transforming the coal – chemically altering it – to create the gas and therefore potentially affects the owners of both the coal rights and the natural gas rights. While the technology is still under development and not commercially available, now is an appropriate time to address split ownership issues.

Recommendation 6.2.1
The Alberta Government should make Crown lessees, freehold owners and industry aware of the risks and associated impacts of split title ownership.

A MAC member brought forward for discussion an issue related to the impact of drainage on mineral rights holders' adjacent lands caused by CBM/NGC development. The MAC also considered a recommendation to amend Crown leasing regulations so that Crown leases offsetting split-title lands retain the current spacing rules of one well per section and full fence line buffer zones until split-title ownership issues are resolved, but consensus was not achieved. There was no agreement by the MAC on recommendations to address these issues.

According to some MAC members, the checkerboard pattern of ownership in Alberta can create a higher level of uncertainty and a lengthier process if industry must acquire freehold as well as Crown rights, and negotiate with multiple parties. While this could possibly deter industry from developing plays, there are options in place to resolve ownership issues, including negotiation and the courts. No recommendations on this issue were put forward.

These issues, while out-of-scope for the MAC, should be addressed through the appropriate processes. A recommendation to strike a committee to resolve these issues did not achieve consensus by the MAC. There was agreement that the government could fill a useful role in providing facilitation to address these issues.

Recommendation 6.2.2
The Alberta Government should set up a process to facilitate parties coming together to work toward resolution of split-title ownership issues.

6.3 Acquiring New Natural Gas Rights in Shallow Zones

Some CBM/NGC developers would like the flexibility to acquire rights for specific (shallow) zones and not have to compete with those who are interested in conventional drilling or in deeper plays. Under the current posting policy, specific zones can only be posted if the intervening zones are leased. Posting for all rights or rights to the base of a certain zone might mean CBM/NGC developers would have to acquire more rights than they are targeting and thus would compete with conventional players.

Deeper Rights Reversion Zone Designations (DRRZDs) were introduced in 1981 as the primary means of defining the base of the zone for P&NG rights at the time of continuation. DRRZDs are also used in the disposition process for P&NG rights. Using a DRRZD would ensure the request encompasses a stratigraphic package of rights and not merely the coal zones. This is important since coal zones are often too small to be economically viable on their own and are difficult to segregate from interbedded sands.

Zone-specific postings would allow companies to acquire the specific rights for which they are interested. This would especially benefit smaller companies. Any proposal to shift to zone-specific postings would be on a 'go-forward' basis, and would not affect rights that have already been acquired. Companies would still be able to post multiple zones to disguise their intentions. Some industry members indicated that they would likely not exercise a zone-specific posting option.

Some surface rights holders believed that a shift to zone-specific posting would result in an increased number of agreements and the potential for more surface impact. However, the common practice of farming out may have the same effect as zone-specific posting. There is also the potential for the Crown to receive more bonuses and annual rent from zone-specific postings.

The MAC also considered whether or not the DOE should allow zone-specific postings using DRRZDs on a go-forward basis. It weighed the potential benefits of allowing greater access to resources, with potentially greater surface disturbances. No consensus was reached on a recommendation.

The MAC believes that if the Alberta Government wants to implement zone-specific postings, it should actively encourage multiple rights holders in a common area to share infrastructure wherever possible and cooperate with surface rights holders. The Best Practices Manual (Section 8.0) developed as part of the MAC process should contribute to reducing the footprint of multiple projects in a common area.

Some industry members are not able to acquire mineral rights for shallower zones because other companies hold mineral rights down to the base of the deepest productive or potentially productive zone. Zone specific retention might be an appropriate tool for returning mineral rights to the Crown for future disposition and opening up increased opportunities for CBM/NGC development. There was discussion by the MAC about implementing zone-specific retention on a go-forward basis for all new agreements issued after a specified date. Some surface rights holders raised the issue of the potential cumulative impacts associated with multiple mineral rights owners. No consensus was reached on a recommendation on zone-specific retention.

The DOE's ability to serve Section 18 Notices of Non-Productivity is a useful process in its own right. If lands and/or rights in an agreement are no longer considered productive, the DOE will serve a one-year notice (Section 18 in the Petroleum and Natural Gas Tenure Regulation). During this year, the lessee must prove the rights productive or the rights will revert to the Crown. The MAC supported the continuing use of this process.

Recommendation 6.3.1
The DOE should review and clarify the criteria for Section 18 Notices of Non-Productivity (See Section 18 in the Petroleum and Natural Gas Tenure Regulation) and aggressively serve these notices. Section 18 Notices on existing agreements should continue to be subject to deeper rights reversion.

Cumulative impacts resulting from multiple mineral rights ownership was a significant issue for some MAC members. This issue is addressed in Recommendation 7.2.1 on project-based planning found in Section 7.0.

6.4 Acquiring New Natural Gas Rights

There was a belief that industry might not be able to acquire sufficiently large blocks of Crown land to accommodate CBM/NGC development. However, the current maximum size (Plains - 15 sections, Northern - 32 sections, Foothills - 36 sections) was deemed to be adequate. Industry will continue to use alternative business arrangements to acquire the area of land they need. No recommendation was put forward.

6.5 Holding Crown-Leased Natural Gas Rights

When a lease reaches the end of its primary term, it expires unless the leaseholder can prove it is productive. If a lease or a spacing unit within the lease has not yet been proven productive, a short-term continuation may be granted. For a potentially productive lease, a one-year continuation may be granted.

Some stakeholders indicated they would like greater flexibility to be able to accommodate test wells, pilot projects and CBM/NGC plays requiring dewatering. A one-year continuation may not be sufficient to accommodate a dewatering phase.

Additional benefits of the recommendation would be to minimize the need for industry to drill at the end of an agreement's term simply to retain the rights. So industry should have sufficient time to plan and develop their CMB/NGC play in a more orderly manner.

Recommendation 6.5.1
The DOE should allow companies an additional one-year continuation under Section 17 of the Petroleum and Natural Gas Tenure Regulation. This additional year would require industry to submit evidence of work conducted during the first continuation period. Also, companies would be charged an increased non-refundable acceptance fee to retain the lands for the second year. The DOE would require additional analysis and consultation on the amount of the fee.

6.6 Developing a Unique CBM/NGC Agreement

The MAC discussed whether CBM/NGC development of Crown land minerals should use a unique agreement. One deterrent to using a unique CBM/NGC agreement would be the challenge of separating coal zones from adjacent sand zones. In addition, gas could migrate between zones, making it difficult to identify trespass situations and calculate royalties. Moreover, single coal zones may not be economically feasible to develop. Furthermore, zone-specific contiguous 'parcels' of rights described by DRRZDs accommodate CBM/NGC and therefore a unique agreement is not necessary. No recommendation was put forward.

6.7 Notification of Activity in Active and Future Coal Mining Areas

A coal rights holder could plan to develop a coal lease on a given property, while a P&NG rights holder on the same property may want to access the coal to develop CBM/NGC. Currently, there is a policy requirement for a P&NG lessee to notify a coal lessee of an intention to develop the resource within a mine permit or mine license area. Companies planning to bid are made aware of this restriction by means of an addendum to the public sales notice. This requirement, however, does not apply to potential coal development areas.

While this may be an issue in the future, so far no problems have occurred. The current process was believed to be adequate. No recommendation was put forward.

7.0 Broad-Based CBM/NGC Issues

7.1 Introduction

There were a number of issues identified by the MAC that were broad in nature and did not deal specifically with water, surface, air, royalty or tenure concerns – but were specific to CBM/NGC or were intensified by CBM/NGC development. The following recommendations address these broad-based issues.

7.2 Project Based Planning & Disclosure

Some landowners have indicated that they do not have sufficient understanding or knowledge of the full extent – and impact – of an energy development project. This is a special concern for developments with a large number of wells, pipelines and other facilities. Furthermore, it is difficult for interested parties to gauge the cumulative impacts of a project, since most applications deal with one well at a time and do not take into account other activities.

Under Alberta's existing guidelines, if a company files an application for a single well license and the well is part of an ongoing project, the company should explain how the well fits into the plan. The current EUB application process encourages, but does not require, project disclosure with potentially affected parties as part of the consultation process, as well as bundling of related applications.

The MAC considered it important to ensure that this process reflect the scale, pace and density of future CBM/NGC developments. These requirements might include expanded project-based planning, disclosure of future plans, focused land use management, cumulative impacts assessment over a broader area, and more community dialogue. Industry as well could benefit from more consistent use of good planning practices, more complete disclosure and increased industry coordination and cooperation.

The MAC has concluded that a more comprehensive and formalized project-based planning approach should be developed for CBM/NGC. This would provide a more complete understanding of the number of surface and subsurface locations, potential environmental and other impacts. In cases involving a large number of wells, high well density or sensitive areas, a more detailed assessment should be required.

Project-based planning should involve all stakeholders in the area, including subsurface rights holders, as well as surface rights holders and occupants. Involving subsurface rights owners in coordinated planning could also provide the forum to address issues such as sterilization and reduced recovery efficiency.

The EUB should provide guidelines about the areal extent for consultation. Opportunities for synergies with other industries could then be better explored and pre-consultation should be promoted.

It is important for surface rights holders as 'land managers' to have a better opportunity to participate in the planning process. This would improve their ability, for example, to request multiple user agreements on new or existing lease

roads, lease sites or pipeline corridors, where it makes sense and is technically feasible. They should also be better able to request other site locations on their property or a reduced number of access roads, in order to minimize surface impacts. These types of decisions could be made earlier and more effectively if project-based planning was in place.

Project-based planning would also improve the ability of regulators and stakeholders to balance the rate of subsurface recovery with surface impact. Project-based planning would benefit surface rights holders and industry by minimizing the need for multiple contacts and follow-up, since negotiations could be undertaken for more than a single well at a time.

Project-based planning may also reduce overall construction time and inconvenience. Industry would be provided with a more comprehensive approval, thereby reducing future regulatory risk.

Recommendation 7.2.1
The EUB and AENV should work with stakeholders to review the application processes for intense CBM/NGC developments to enhance and promote project-based planning and disclosure. This would allow:

- Definition of intense project developments
- Full project disclosure
- Improved community consultation
- Enhanced impact assessment
- Review of mitigation measures

7.3 Public Consultation Notification Distances

A number of issues related to consultation with surface rights holders was discussed by the MAC. The specified minimum distance for notification and consultation was identified as a concern by some stakeholders. They felt that the requirement for energy companies to consult with directly affected surface rights holders is too limiting in the case of CBM/NGC, which may have impacts on aquifers some distance away from a given development.

Under the EUB's Guide 56, a minimum 100 m distance for notification of and consultation with all affected stakeholders is used for situations deemed to have the lowest risk such as sweet gas wells. Much greater distances could be indicated for higher risk projects such as sour gas. The EUB further directs industry to understand local issues and expand consultation as appropriate. Companies must respond to all reasonable questions, attempt to address concerns from surface rights holders and occupants, and inform the EUB of all outstanding concerns, regardless of how far the concerned individual is situated from the project site.

The AENV consultation process applies whenever non-saline water production is involved. It requires a minimum preliminary groundwater assessment including a field-verified survey of all existing water wells, springs and dugouts within a minimum 1.6 km radius of the proposed site, their normal flow rate/yield, and the purpose of the requested diversion. A professional hydrogeological assessment of any unique local features is also undertaken to determine if the review should

be expanded. (For more information, see the Water Section, 3.0.) A formal non-saline water diversion application is subject to newspaper advertisement. Public statements of concern can be made by parties living a considerable distance from the project site.

The MAC discussed recommending an increase in both standard minimum distances for both the EUB and AENV, but agreed that the analysis to determine the most appropriate distance should be undertaken in a broader context of reviewing the entire consultation process.

Recommendation 7.3.1
The EUB, AENV and ASRD with stakeholder input should review all guidelines that relate to public input opportunities and notification to ensure the guidelines are appropriate for CBM/NGC development.

7.4 Enhanced Regulatory Coordination

Stakeholders indicated that information does not flow quickly or easily enough between the various bodies that regulate natural gas, water and land use.

With the potential for more non-saline water issues resulting from CBM/NGC development, the timely sharing of information among regulatory bodies is important. A more coordinated, harmonized regulatory process along with a more integrated comprehensive planning process, would improve efficiency, as well as address issues such as cumulative surface impact and non-saline water diversions more effectively.

Recommendation 7.4.1
The EUB, AENV and ASRD should improve the coordination of their CBM/NGC-related application and surveillance processes and develop electronic solutions to facilitate data exchange.

7.5 Accessible Current Public Information and Communication

Many stakeholders stated that they are not adequately informed about CBM/NGC development and are, therefore, concerned about potential effects. They believe the public needs more timely, accessible information on CBM/NGC. Efforts to improve the flow of dialogue are already underway. Synergy Alberta, the umbrella organization for local groups to learn about and deal with energy-related issues, is an example of one initiative that has been implemented to help educate and empower local stakeholders.

Information on wells, production and facilities is available to the public, but is not easily accessible, with only a limited number of locations where the information can be obtained.

The MAC agreed that the public needs timely and easy access to information. It also agreed that industry and government need information to continue to improve the management of potential impacts associated with CBM/NGC development. Web sites, open houses and other activities all offer opportunities for information exchange and should also be fully utilized. Information should be more broadly available, e.g., in libraries, municipal offices and EUB field offices.

Recommendation 7.5.1
Industry, regulators and other stakeholders should increase the opportunity for dialogue, education and awareness of the public, surface and subsurface rights holders, leaseholders and industry on the possible impacts resulting from CBM/NGC development, and how the use of the land will be affected.

The MAC also noted that a comprehensive CBM/NGC public database would enhance transparency, provide open disclosure and help educate and inform members of the public who want to be involved.

Recommendation 7.5.2
The EUB and AENV should consolidate CBM/NGC data in a publicly accessible and user-friendly database that includes information on postings, wells (e.g., drill logs), applications and approvals, chemical analyses and water production rates, well location, coal formation, production intervals, and monitoring data. The availability of data should be subject to the normal provisions of confidentiality.

A particular source of confusion for surface and subsurface rights holders and other members of the public is the EUB's reference to 'wells per section per pool' in spacing orders. This has led, in some cases, to the extrapolation of potential numbers of wells far beyond the expectations of regulators and industry. This has heightened concerns over the potential proliferation of wells. The MAC concluded that clarifying EUB references to 'wells per section per pool' and communicating it to surface rights holders and the public would help address concerns.

Recommendation 7.5.3
The EUB should create an easy-to-understand public explanation for 'wells per section per pool' as it refers to CBM/NGC development.

The MAC identified that a specific concern for a number of stakeholders relates to a misunderstanding of setbacks. The EUB requires industry to place their facilities no closer than 100 m from structures intended for human accommodation. To address nuisance factors such as noise and scheduled workovers, municipalities can also impose their own setback restrictions associated with sour gas facilities, over and above EUB requirements. However, the municipality shall not approve a setback application that does not conform to EUB requirements, unless the EUB has provided written approval for a lesser setback distance at the request of a landowner or developer. In certain circumstances, the EUB may allow structures intended for human accommodation within 100 m of a sweet gas facility, but under no circumstances would there be any reduction in setback for a sour gas facility.

Some farmers would like the opportunity to put farm buildings and structures closer to a CBM/NGC well site than 100 m. There is a lack of consistency in how this type of request is being handled by local authorities.

Recommendation 7.5.4
The EUB and the Department of Municipal Affairs along with other stakeholders should clarify and communicate the requirements, roles and responsibilities related to setbacks.

The EUB, in response to recommendations from the public safety and sour gas initiative, has been preparing decision reports with the goal to better show how the public interest has been reflected in the decision. The MAC encourages the EUB to continue this helpful practice.

Finally, the MAC concluded that all of these efforts could be part of a broader communications initiative to share information about CBM/NGC and its potential impacts. The public consultation initiative that contributed input for this document is a good start, but a follow-up communication plan is needed to address some of the communication issues that were raised during this process.

Recommendation 7.5.5
Government and industry should continue to work with stakeholders to develop and implement a communication plan to provide Albertans with better information on CBM/NGC issues, including potential effects on water supply.

7.6 Review to Assess Progress

Implementation of all the recommended changes in this document in a timely manner will promote safe and orderly CBM/NGC development. To ensure accountability in the implementation of the recommendations as well as to ensure their effectiveness, reviews are required.

Recommendation 7.6.1
As recommendations in this document are implemented, it is recommended a multi-stakeholder committee be established by the Assistant Deputy Ministers Sponsors' Committee to conduct a review with the following components:

- Annual reviews for three years to assess progress according to a monitoring plan.
- A second overall review in three years to assess:
  1. The effectiveness of the recommendations,
  2. New issues or information, and
  3. An assessment as to whether additional recommendations are needed.

7.7 Sufficient Resources

Some stakeholders expressed concerns that the government departments and agencies had good rules in place, but insufficient resources to enforce them.

The MAC recognized that the energy industry is changing and growing at a rapid pace. The growth of CBM/NGC development in the future will bring many new challenges. The MAC agreed that various government departments and agencies may need to address resourcing issues in order to be able to deal with these challenges, as well as to implement the recommendations outlined in this document.

Recommendation 7.7.1
Appropriate government departments and agencies should have sufficient resources to be able to implement these recommendations effectively and efficiently.

8.0 Best Practices Manual

Best practices can be defined as: management practices or techniques recognized to be the most effective and practical means to develop the resource, while minimizing adverse environmental and other effects. However, not all these practices are being followed by all CBM/NGC operators. The MAC agrees that some current practices are highly effective and that all industry members should be encouraged to adopt them.

The 'Coal Bed Methane Best Management Practices - A Handbook, Western Governors' Association, 2004' was identified as an example of how industry members in the U.S. learned about best practices for their region. A similar best practices manual, based on Alberta's unique geography and legislation, would be useful. Industry has taken the initiative to begin developing such a manual in parallel with the MAC consultation process. This manual will complement regulations and provide expanded guidance to industry members.

The manual will benefit not only the companies themselves, but will also help educate surface and subsurface rights holders about practices they can anticipate when dealing with an energy company, as well as help them plan and manage their own property for the future. A best practices manual will allow surface and subsurface rights holders with concerns to compare the practices on their land with the leading edge practices of the day.

One example of a best practice would be for industry to approach other operators in the area to share facilities and infrastructure before an application is filed. Another best practice could be to post signage to notify residents of the timing and other details of local activities that might affect them. The best practices manual could also address unregulated issues such as visibility concerns. The ultimate outcome would be enhanced trust among all stakeholders and industry.

A draft best practices manual is being prepared by industry and will be submitted to the MAC for review. Once the manual has been finalized, it will be made available to all stakeholders through various government and industry web sites.

Recommendation 8.1.1
Industry, government and other stakeholders should work together to develop, document and implement best practices for CBM/NGC operations.

Recommendation 8.1.2
Regulators should review CBM/NGC activities in other jurisdictions to ensure Alberta gains the benefit of studies and experience elsewhere (e.g., Report entitled: Coal Bed Methane Best Management Practices - A Handbook, Western Governors' Association, 2004).

9.0 Non CBM/NGC Specific Issues

9.1 Introduction

There were a number of issues identified by the MAC that were broad in nature and did not deal specifically with water, surface, air, royalty or tenure concerns – nor were they specific to CBM/NGC development. The following recommendations address some of these issues.

The MAC also discussed the potential impact on property values resulting from CBM/NGC operations and the landowner's ability to use the land as collateral. Financial institutions may not be clear about the process of reclaiming the land. Currently, companies are liable for surface reclamation issues at upstream oil and gas sites for 25 years. The Oil and Gas Reclamation and Remediation Advisory Committee was established in June 2003 to suggest enhancements to Alberta Environment's reclamation program. Several recommendations relate to clarifying reclamation liability. The MAC is not putting forward any recommendations in this area.

9.2 Short-Term Noise

Some surface rights holders expressed frustration at not being able to quickly resolve a sudden noise problem. They are not aware of whom to call – or the process to deal with this kind of a situation.

There are many rules and regulations to control most kinds of noise, as outlined in the EUB's Guide 38. An existing ongoing committee addresses noise issues of a technical nature. However, short-term noise, such as the use of retarder brakes, is not regulated.

The MAC agreed that some guidelines for industry and procedures for surface rights holders would help resolve short-term noise issues more quickly. These guidelines should be included in industry's best practices manual (See Section 8.0). Industry must communicate these practices to its subcontractors, as well as any conditions negotiated with surface rights holders.

Recommendation 9.2.1
Industry, regulators and other stakeholders should develop and communicate practices and procedures to deal quickly with short-term noise complaints that are not currently covered under the EUB's Guide 38.

9.3 Timing of Hearings

Some surface rights holders expressed a need for recognition of critical agricultural periods in the timing of EUB hearings. They want to be fully engaged in the process so as to have a fair opportunity to express their concerns.

Under the existing process in Alberta, the EUB considers the needs of all parties to ensure fairness in the scheduling of a hearing. This includes recognition of the importance of surface rights holders' activities, such as seeding, harvesting or calving, in setting hearing dates. The timing of various agricultural practices is different in different parts of the province, so location has to be factored in as well. The MAC agreed that the EUB should continue this practice.

Recommendation 9.3.1
The EUB should continue to take into consideration the timing request of the surface rights holder/leaseholder during critical agricultural periods and not call a hearing at those times.

9.4 Notification of Sales Results

The results of mineral rights sales, while available to the public, are not produced in a user-friendly format. Some surface rights holders would like the opportunity to be proactive in tracking and managing the development of mineral rights under their land after the rights have been sold.

Recommendation 9.4.1
The DOE should review the full range of paper to electronic options of notification and should work with local government and other agencies to provide current P&NG sales data in a user-friendly format (including map format) to local and/or rural offices such as county offices, agricultural offices and public libraries.

Recommendation 9.4.2
The DOE should provide instructions on its website on the process for conducting an information search by land or by mineral agreement.

9.5 Land Agents Accountability

The Canadian Association of Petroleum Landmen (CAPL) is a professional organization for people involved in all aspects of petroleum land management. There are several types of land agents:

1. Land agents, who must be licensed under the *Land Agents Licensing Act* if their responsibilities include obtaining surface interest in the land (e.g., wellsite) or taking documentation leading to the acquisition of a surface interest.
2. Geophysical permit agents, who are not licensed, obtain consent from surface rights holders and usually negotiate damage settlements for geophysical or seismic activity.
3. Freehold mineral leasing agents, who are not licensed, obtain sub-surface rights from freehold mineral rights holders.

The lack of professionalism on the part of some agents has resulted in mistrust, inconsistency and reduced protection for surface rights holders. Communications have been a major concern. For example, surface rights holders are not always notified that they have a minimum 48 hours to consider an offer prior to resuming negotiations with a company. Some of these issues have already been communicated directly to the EUB.

To enhance the professionalism of land agents, CAPL, the Canadian Association of Petroleum Producers, the Small Explorers and Producers Association of Canada, and the Alberta Association of Surface Land Agents have begun to develop a certification process. Land agents will be encouraged to be certified and to maintain their certification over the course of their active career. Education will be an important component of the certification process, including ethics and conflict resolution courses. Industry will be encouraged to hire certified land

agents and encourage their agents to use appropriate tools and techniques. The MAC supports this certification initiative and its implementation. No certification for the other types of agents is being considered at this time, and is beyond the scope of the MAC.

Recommendation 9.5.1
The Alberta Government, including Human Resources and Employment, should expedite the industry initiative to improve the continuing education/certification of land agents, including periodic recertification, and if necessary, amend legislation to provide for same.

9.6 Wildlife

It is also important that industry continue to consider critical periods for wildlife and minimize development-related disturbances to habitat. Continuing consultation by industry with ASRD on appropriate timing and development strategies will help reduce the impacts.

Recommendation 9.6.1
Industry should continue to consult with ASRD in consideration of minimizing disturbance to wildlife habitat and scheduling activities to address critical wildlife periods.

9.7 Caveats

The MAC was advised that the amendment or registration of caveats reflecting deep rights reversion on freehold owner leases was not allowed by Alberta Land Titles. As a result of this policy, any party interested in a freehold owner's mineral rights must spend time doing research to determine if there are any available deep rights, adding to the cost of doing business on freehold lands for the oil and gas industry. Until deep rights reversion on freehold leases becomes more commonplace, most industry operators may not go to the trouble of searching multiple caveats to identify those mineral rights that are subject to deep rights reversion or zone specific leases. Given the competitive nature of the CBM/NGC industry, the MAC supports the principle of a level playing field and increased transparency of information related to caveats.

Recommendation 9.7.1
The Government of Alberta should require Alberta Land Titles to ensure as much transparency of information as possible is included on certificates of title to mineral rights.

Acronyms and Glossary of Terms

Acronyms:

ACD	Alberta Community Development
ADR	Appropriate Dispute Resolution
ASRD	Alberta Sustainable Resource Development
AENV	Alberta Environment
AGS	Alberta Geological Survey
BGWP	Base of Groundwater Protection
CAPL	Canadian Association of Petroleum Landmen
CASA	Clean Air Strategic Alliance
CBM/NGC	Coalbed Methane/Natural Gas in Coal
DOE	Department of Energy
DRRZDs	Deeper Rights Reversion Zone Designations
EAB	Environmental Appeals Board
EPEA	Environmental Protection and Enhancement Act
EUB	Alberta Energy and Utilities Board
FHOA	Freehold Owners Association
IOGC	Indian Oil and Gas Canada
MAC	Coalbed Methane/Natural Gas in Coal Multi-Stakeholder Advisory Committee
P&NG	Petroleum and Natural Gas

Glossary of Terms

(as used in the Preliminary Findings)

Abandonment: The permanent dismantlement of an oil or gas well or facility in the manner prescribed by the regulations including any measures required to ensure that the facility is left in a permanently safe and secure condition.

Appropriate Dispute Resolution (ADR): A term that reflects a number of alternatives or means to resolve conflicts between parties. It can include direct negotiations, facilitated sessions, mediations, or arbitration between conflicting parties, as well as the public hearing process. The EUB encourages conflicting parties to use available ADR options when conflict arises with respect to energy development.

Aquifer: As defined by the Alberta Government's *Water Act*, an underground water-bearing formation that is capable of yielding water.

Best practices: Management practices or techniques recognized to be the most effective and practical means to develop the resource, while minimizing adverse environmental and other effects.

Casing: A series of tubular pipes joined by threads and couplings that line a well bore to prevent water and rock from entering into the well bore.

Checkerboard: The configuration of freehold and Crown mineral ownership as a result of the Canadian Pacific Railway (CPR) Company grant. To subsidize the building of a trans-continental railway, the Dominion of Canada granted to the CPR a large area of land adjacent to the right-of-way. The grant, which included both surface and mineral rights, was for every odd-numbered section in each township except sections 11 and 29.

Coal: A black or brownish-black solid combustible substance formed by the partial decomposition of organic matter without access to air.

Coal seam: Descriptive term for individual layers of coal found in the geological strata. It is also called a 'bed' in the coal industry.

Coal zone: A vertical extent of intermittent coal seams and intermingled shale or clay. The zone extends from the top of the uppermost seam to the bottom of the lowermost one.

Coalbed methane (CBM): Methane found in coal deposits. Also called Natural Gas in Coal (NGC).

Commingling (oil & gas): Mixing oil and or gas from two or more different pools in the same well bore.

Commingling (water): Mixing water from two or more **different** aquifers in the same well bore.

Conventional natural gas: Natural gas consisting of a mixture of hydrocarbon compounds, primarily methane, and small quantities of various non-hydrocarbons that exist in gaseous phase or in solution with crude oil in natural underground reservoirs.

Crown: Depending on jurisdiction, the Crown is either represented by the federal or Alberta government.

Crown Mineral Disposition Review Committee: An interdepartmental committee made up of representatives from provincial government departments and agencies. The committee reviews land parcels requested for mineral disposition to ensure the date (ecological reserves, grazing reserves, parks, historic sites, etc.) is current and the level of access is correct.

Deeper Rights Reversion Zone Designation (DRRZD): Identifies a zone by its name. As noted in ERCB Decision 95-10, historically, the name of the zone identified within type wells takes precedence over the depths identified in terms of utilizing a DRRZD. DRRZDs are used primarily for deeper rights reversion, but can also be used for other purposes such as offsets.

Drilling fluid: The circulating fluid (mud) used to bring drilling cuttings out of the well bore, cool the drill bit, and provide hole stability and pressure control. Drilling mud includes a number of additives to

maintain the fluid at desired viscosities and weights. Some additives may be caustic, toxic, or acidic. Drilling fluids are also needed to complete water wells.

***Environmental Protection and Enhancement Act* (EPEA):** Provincial legislation that takes an integrated approach to the protection of Alberta's air, land, and water. One of the Act's cornerstones is the guarantee of public participation in decisions affecting the environment. Public involvement includes access to information, participation in environmental assessment and approval processes, and the right, when directly affected, to appeal certain decisions.

Footprint (also called environmental footprint): The impact of an organization, company or business entity in environmental terms (resource use, waste generation, physical environmental changes etc).

Formation: A designated subsurface layer that is composed of substantially the same kind of rock or rock types.

Fracturing: A method of improving the permeability of a reservoir by pumping fluids such as water or carbon dioxide, and nitrogen into the reservoir at sufficient pressure to crack or fracture the rock. It is also known as 'fracing'.

Freehold rights: Mineral rights not owned by the Crown in right of Alberta. These mineral rights may be owned by the Crown in right of Canada, by corporations or individuals.

Gas-in-place: The amount of gas in a reservoir at any time calculated at standard conditions. This includes recoverable and non-recoverable gas.

Groundwater: Water that occurs under the surface of the ground.

Initial gas in place: The volume of raw natural gas calculated or interpreted to exist in a reservoir before any volume has been produced.

In place: See 'Initial gas in place'

Landowner: See 'Surface rights holder'

Lessee: Defined in the *Mines and Minerals Act* as the holder according to the records of the Department of Energy of an agreement. The term 'lessees' may, therefore, refer to holders of leases or licenses or both, depending on the context in which it is used.

Methane: The most prevalent component of most natural gas produced in Alberta. Its chemical notation is CH_4 and it is the most common hydrocarbon gas.

Mineral rights: Entitlement, through ownership or a leasing arrangement, to produce and sell the minerals in a parcel of land.

Migration: Movement from one place to another.

Natural Gas in Coal: Methane found in coal deposits. It is also called Coalbed Methane (CBM).

Non-saline water: Fresh water with total dissolved solids content less than 4000 milligrams per litre. See also 'Saline groundwater'.

Operator: The company or individual responsible for managing an exploration, development, or production operation.

Pool: A natural underground reservoir containing an accumulation of oil or gas or both, separated or appearing to be separated from any other such accumulation.

Porosity: Open spaces within a rock that contain fluids such as water, oil, or natural gas.

Potentially productive: Used to refer to a well, a zone or a spacing unit that cannot be demonstrated at the required level of proof to be productive, but displays indications that it might be productive if further work were conducted.

Produced water: The water extracted from the subsurface along with produced oil and gas, including water from the reservoir, water that has been injected into the formation, and any chemicals added during the production/treatment process.

Reclamation: Process of restoring surface environment to acceptable pre-existing conditions.

Recompletion: A recompletion occurs when the producer re-enters a well to complete (i.e., perforate) a new formation in a previously completed well.

Remediation: Cleanup of an environmentally contaminated site.

Saline groundwater: Water that has total dissolved solids content exceeding 4000 milligrams per litre as defined in the Water (Ministerial) Regulation.

Section: An area one mile square or as close as the convergence of the meridians permit.

Sensitive areas: Lands or associated features requiring protection, including critical wildlife habitat, rare and endangered plant species, native prairies, areas prone to erosion or other geotechnical failure, or cultural heritage sites.

Split title: Where subsurface rights are owned by different parties, e.g., the Crown owns the coal rights and the P&NG rights are freehold, or vice versa, or two separate freehold owners exist.

Subsurface: Below the surface.

Subsurface rights holder: The owner or lessee of the mineral rights who has the right to explore for and produce oil, gas, and other minerals. The owner may be a freehold rights owner or the Crown.

Surface rights holder: The owner or lessee of the surface rights (the landowner) has control of the land's surface and the right to work it, in addition to any sand, gravel, peat, clay or marl which can be excavated by surface operations.

Total Dissolved Solids (TDS): A measure of concentration or how much substance is in a given sample.

Tenure: Term used to describe the system whereby mineral rights are managed by the Department of Energy and disposed to individuals and companies as agreements.

Township: A term used in the 'Alberta Township System'. Depending on the context in which it is used, it refers either to a six square mile area comprising 36 sections or to a row of townships spanning from north to south across Alberta. Township 1 lies at the southernmost boundary of Alberta and Township 126 lies at the northernmost boundary.

Unconfined aquifer: An aquifer containing water that is not under pressure. The water level in a well completed in an unconfined aquifer is the same as the water level (water table) outside the well.

Water Act: The Alberta *Water Act* protects the quality of water and manages its distribution. The legislation regulates all development and activities that might affect rivers, lakes, and groundwater.

Water quality: Refers to a set of chemical, physical, or biological characteristics that describe the condition of a river, stream, lake, or aquifer.

Water well: As defined in the *Water Act*, an opening in the ground, whether drilled or altered from its natural state, which is used for:

1. the production of groundwater for any purpose,
2. obtaining data on groundwater, or
3. recharging an underground formation from which groundwater can be recovered and includes any related equipment; buildings, structures and appurtenances.

Well density: The concentration of wells on the land surface (per unit area).

Well spacing: The distance between wells producing from the same reservoir. Spacing is often expressed in terms of area (e.g., 40-acre spacing) and is usually established by regulatory agencies.

Zone: Defined in the Petroleum and Natural Gas Regulation as a stratum or series of strata considered by the Minister to be a zone for the purposes of this Regulation. In many cases, zones may be geological formations or members but in some instances they are larger (geological groups) and include more than one formation (the Mannville zone, for instance, includes numerous formations).

Appendix A MAC Members

As of May 2005

Alberta Agriculture, Food and Rural Development	John Hermans James Wuite (alternate)
Alberta Association of Municipal Districts & Counties	Phyllis Kobasiuk Ken Hoppins (alternate)
Alberta Beef Producers	Gene Rawe
Alberta Energy	Mike Ekelund (chair) David Breakwell (alternate) Sharla Rauschning (alternate chair)
Alberta Environment	Bev Yee (co-chair) Nga de la Cruz (alternate)
The Pembina Institute (Alberta Environmental Network Society)	Mary Griffiths Tom Hegan (alternate)
Alberta Environmentally Sustainable Agriculture Council	Sharil Baumgardner
Alberta Surface Rights Federation	Tom Nahirniak Karl Zajes (alternate)
Alberta Sustainable Resource Development	Barry Cole Keith Beraska (alternate)
Butte Action Committee/Rimbey & District Clean Air People	Don Bester
Canadian Association of Petroleum Landmen	Deryl Hurl
Canadian Association of Petroleum Producers/ Canadian Society For Unconventional Gas/ Small Explorers And Producers Association of Canada	Mike Gatens
Canadian Association of Petroleum Producers/ Canadian Society For Unconventional Gas/ Small Explorers And Producers Association of Canada	John Squarek Dave Rushford (alternate)
The Coal Association of Canada	Robert Donick Allen Wright (alternate)
Energy and Utilities Board	Bob Willard Tom Byrnes (alternate)
Freehold Petroleum & Natural Gas Owners Association	Brad Murray Else Pedersen (alternate)

Others:	
Alberta Community Development -- Facilitator	Gene Roach
Alberta Energy -- Secretariat	Karen Henderson
Writer/Consultant	Sari Shernofsky

The MAC would like to express its appreciation to all the MAC members and alternates who participated at various points in the process, including those who took part in the early stages of the initiative. We also would like to take this opportunity to thank all the members of the working groups, who contributed so much time and effort into researching and understanding the issues and putting forward its own recommendations for MAC to consider. Lastly, we would like to thank all the members of the public who attended our public meetings and provided their input to the MAC. We have strived to develop a set of recommendations that reflects their concerns to the degree that it is within our mandate.

Appendix B Out-of-Scope Issues

The following issues were raised at public information sessions, by the working groups or by MAC members. They are considered out-of-scope for the MAC and will be referred to the appropriate organization. The MAC has no position on these issues.

Issue	***Referral Organization***
Compensation should reflect all costs, and may need to be higher with CBM/NGC	Surface Rights Board
Review period for long-term surface leases	Surface Rights Board
Compensation should reflect any increased number of pipelines	Surface Rights Board
Extending the 48-hour review period for landowners for CBM/NGC drilling	Land Agent Advisory Committee
Changes to existing regulations on linear assessment due to increased traffic load from CBM/NGC	Municipal Affairs
Net metering to allow individuals generating their own power to sell surplus power into the provincial grid	Electricity and Gas Division, Alberta Energy
Plugging seismic holes from bottom to top as part of the reclamation process	ASRD
Banks sometimes will not accept agricultural land used for energy activities as collateral for a loan because of reclamation concerns	Environmental Assurance, Alberta Environment and the EUB
Expanding ADR membership to include additional landowner groups and freehold owners	EUB
Longer term sustainability of the Orphan Well Fund through alternate funding such as royalties	EUB and Alberta Energy
Increased compensation for landowners because of the increased impact associated with horizontal/directional drilling	Surface Rights Board

Appendix C CBM/NGC Well Activity & Production Fact Sheet

All values to December 31, 2004

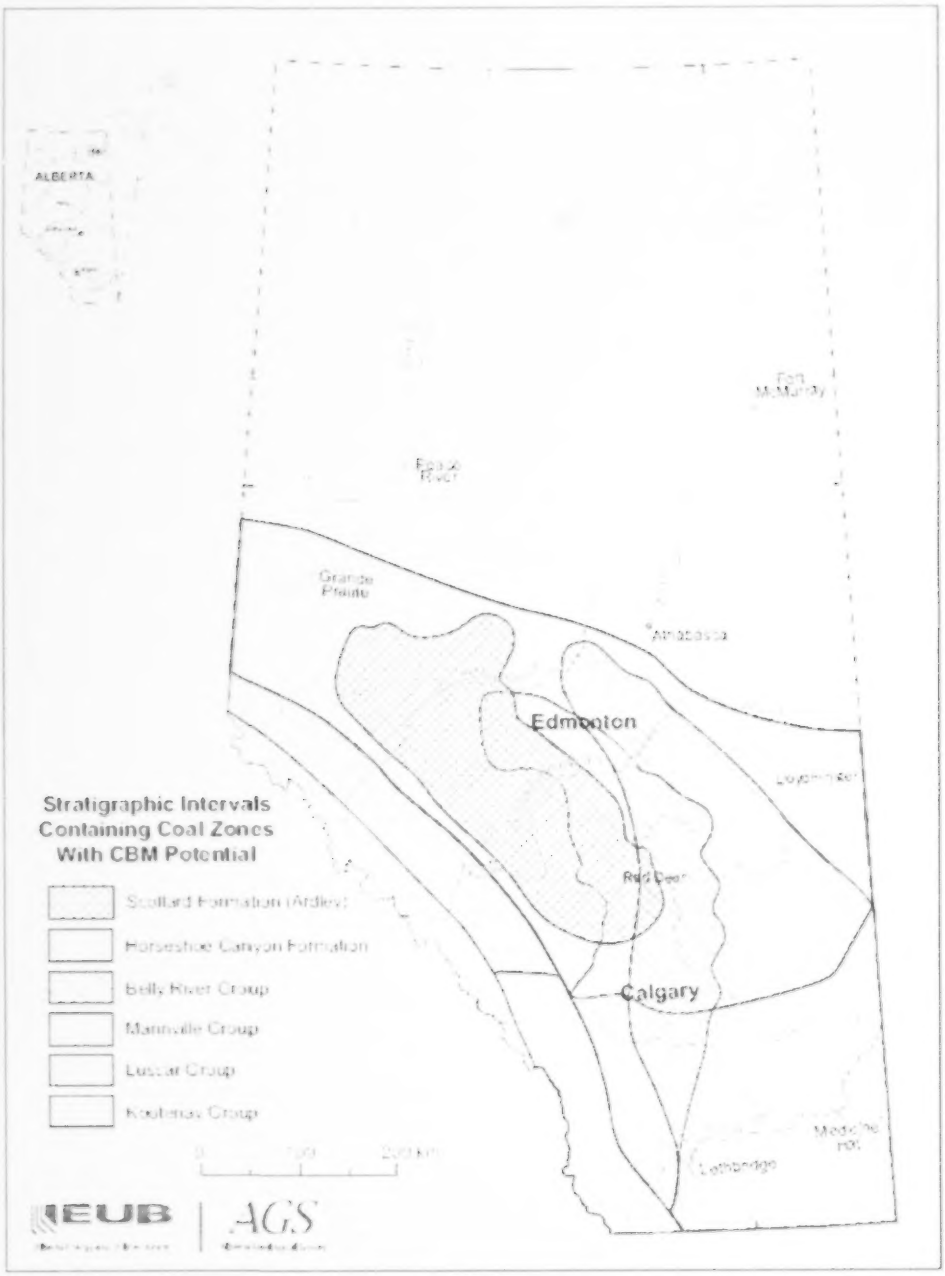
Coal Zone/Formation	Total Wells	Wells With Production	Cumulative Gas Production From Only Coals (10^6 m^3)	Cumulative Water Production From Only Coals (10^3 m^3)
Horseshoe Canyon & Belly River	3240	1560	657	62*
Mannville	240	127	79	548
Ardley	58	32	19	21
Kootenay	37	16	<1	<1
Total	3575	1735	755	631

* Most wells produced little or no water; 3 wells account for 24 X $10^3 m^3$ of the reported cumulative water production.

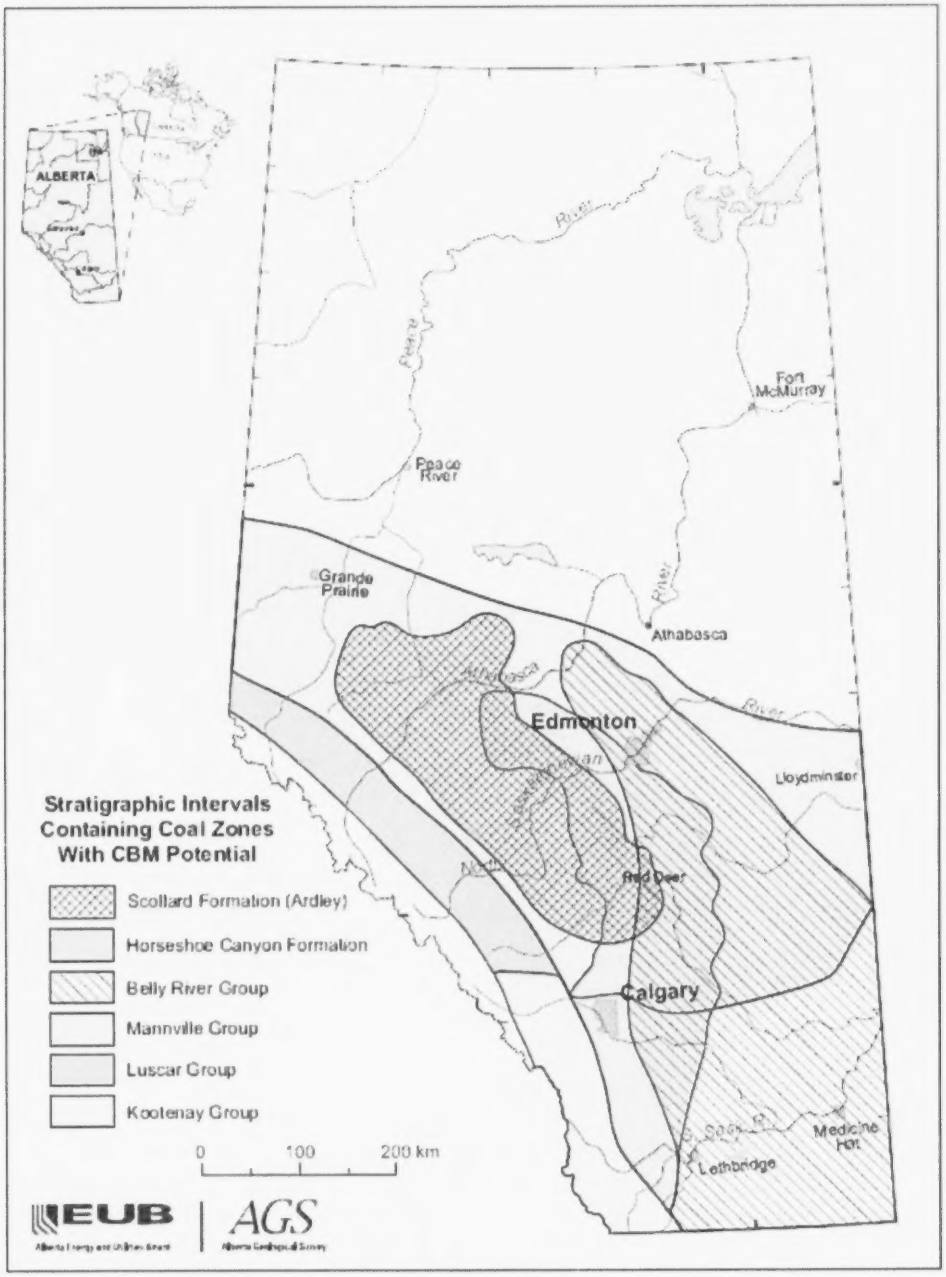
Number of CBM/NGC wells added in 2004: 2506

CBM/NGC well production in 2004: 600 X 10^6 m^3 (from only coals)

Map of Potential CBM/NGC Coal Zones (Source: EUB May 2005)



Map of Potential CBM/NGC Coal Zones (Source: EUB May 2005)



Appendix D Summary of Regulatory Requirements for CBM/NGC Activities – Alberta

All Acts, regulations and requirements that pertain to natural gas also pertain to CBM/NGC development in Alberta; therefore, knowledge of all Acts, regulations and requirements that pertain to natural gas is required in the development of CBM/NGC.

This table provides only a summary of the main areas of regulation. This summary is extracted from the current draft (June 2005) of the CBM/NGC Best Practices document that is being prepared for the MAC. Changes to this summary will be incorporated in the final MAC report.

Activity		Approvals or Authorizations Required (Regulatory Agency)	Legislation / Regulatory References
Notifications and Consultations	Notification & consultation with landowners/ managers, public, mineral rights owners, etc.		• EUB Guide 56: Energy Development Application Guide • EUB Guide 60: Upstream Petroleum Industry Flaring Guide (plus updates) • EUB Guide 65: Resources Applications for Conventional Oil and Gas Reservoirs. • EUB Guide 71: Emergency Preparedness and Response Requirements for the Upstream Petroleum Industry
Mineral Tenure	Petroleum & Natural Gas Rights - provincial Crown lands	Petroleum & Natural Gas Rights (Alberta Energy)	• Mines and Minerals Act (Ch. M-17, RSA 2000) • Petroleum and Natural Gas Tenure Regulation (AR 263/97)
	Petroleum & Natural Gas Rights - provincial freehold lands	Petroleum & Natural Gas Rights (freehold mineral rights owner)	
	Petroleum & Natural Gas Rights on Indian lands	Permit or Lease (IOGC)	• Indian Oil and Gas Regulations (SOR/94-753). • Indian Oil and Gas Canada. 2001. Disposition of Oil and Gas Rights Policy.
Exploration	Geophysical operations on provincial lands	Exploration Approval (ASRD)	• Public Lands Act (Ch. P-40, RSA 2000) • Exploration Regulation (AR 214/98)
	Geophysical operation on Indian lands	Exploratory License (IOGC)	• Indian Oil and Gas Regulations (SOR/94-753). • Canadian Environmental Assessment Act (1992, c.37) • Indian Oil and Gas Canada. Information Letter IOGC IL-2000 How to Prepare the Environmental Assessment

Activity		Approvals or Authorizations Required (Regulatory Agency)	Legislation / Regulatory References
			Required Pursuant to the Canadian Environmental Assessment Act
Well Spacing	Special drilling Spacing unit	Special Drilling Spacing Unit Order (EUB)	• Oil and Gas Conservation Regulations (AR 151/87) • EUB Directive 65: Resources Applications for Conventional Oil and Gas Reservoirs
	Holding	Holding Approval (EUB)	• Oil and Gas Conservation Regulations (AR 151/87) • EUB Directive 65: Resources Applications for Conventional Oil and Gas Reservoirs
Well Siting	Well location less than prescribed setback distances	Approval (EUB)	• Oil and Gas Conservation Regulations (AR 151/87)
	Municipal development (residential, agricultural, industrial) location less than prescribed setback distances	Approval (EUB)	• Subdivision and Development Regulation (AR 43/2002)
	Well siting on provincial private lands		AENV. 2003. Information Letter R&R/03-2. Siting an Upstream Oil and Gas Site in an Environmentally Sensitive Area on Private Land: Guidance for Private Land
Surface Rights	Surface rights on private lands for wellsites, facility sites, access roads and related developments	Surface Lease (landowner), or Right of Entry Order (SRB)	• Surface Rights Act (Ch. S-24, RSA 2000) • Surface Rights Act General Regulation (AR 189/2001) • Surface Rights Act Rules of Procedure and Practice (AR 190/2001)
	Surface rights on provincial Crown lands wellsites, pipelines, facility sites, access roads and related developments	Mineral Surface Lease (wellsite); License of Occupation (road); (ASRD)	• Public Lands Act (Ch. P-40, RSA 2000) • ASRD. 2004. Public Lands Operational Handbook. • ASRD. 2004. Area Operating Agreement Guidelines for Public Lands • ASRD. 2004. Instructions for Submission of Environmental Field Reports with Surface Disposition Applications under the Public Lands Act
	Surface rights on Indian lands for wellsites, pipelines, facility sites,	Surface Lease, Right-of-Way, or Right of Entry (IOGC)	• Indian Oil and Gas Act (R.S. 1985, c. I-7) • Indian Oil and Gas Regulations, 1995. (SOR/94-753) • Canadian Environmental Assessment Act (1992, c. 37) • Indian Oil and Gas Canada. Information Letter

Activity		Approvals or Authorizations Required (Regulatory Agency)	Legislation / Regulatory References
	access roads and related developments		IOGC IL-2000 How to Prepare the Environmental Assessment Required Pursuant to the Canadian Environmental Assessment Act
Wellsite, Facility Site and Access Road Construction	Design and construction of wellsites, facility sites and related access roads.	Surface Lease Agreement with Owner/Occupant of Private Land OR Disposition from Manager of Public Lands	• EPEA (Ch.E-12, RSA 2000) • EUB Information Letter IL 2002-01: Principles for Minimizing Surface Disturbance in Native Prairie and Parkland Areas • EUB Information Letter IL 90-21: Oil and Gas Development – Rumsey Block • AENV. 2003. Information Letter R&R/03-07: Wellsite Construction: Guidelines for No-Strip and Reduced Disturbance. ASRD. 2004. Public Lands Operational Handbook
	Historical resources assessment and mitigation	Clearance (ACD)	• Historical Resources Act (Ch. H-9, RSA 2000)
	Watercourse Crossings	Notification (AENV)	• Water Act (Ch. W-3, RSA 2000) • Water (Ministerial) Regulation (AR 205/1998) • AENV. Code of Practice for Watercourse Crossings
	Activities in or around navigable waters	Clearance or Approval (Canadian Coast Guard)	• Navigable Waters Protection Act (R.S. 1985, C. N-22)
	Activities that may affect Species at Risk	(ASRD)	• Wildlife Act (Ch. W-10, RSA 2000) • Wildlife Regulation (AR 143/97)
	Activities in or near fish habitat	Letter of Advice or Authorization (Fisheries and Oceans Canada)	• Fisheries Act (R.S. 1985, c. F-14) • Fisheries and Oceans Canada. Policy for the Management of Fish Habitat • Species at Risk Act (2002, c. 29)
Well Drilling	Drill and complete a well on provincial lands	Well License (EUB)	• Oil and Gas Conservation Regulations (AR 151/87) • EUB Guide 56: Energy Development Application Guide • EUB Bulletin 2005-04
	Drill and complete a well on Indian lands	Well License (IOGC)	• Indian Oil and Gas Regulations, 1995. (SOR/94-753)
	Drilling rig operations		• EUB Directive 036: Drilling Blowout Prevention Requirements and Procedures
	Surface Casing		• EUB Guide 8: Surface Casing Depth Minimum Requirements
	Casing Cementing		• EUB Guide 9: Casing Cementing Minimum Requirements
	Casing		• EUB Guide 10: Guide to Minimum Casing Design

Activity		Approvals or Authorizations Required (Regulatory Agency)	Legislation / Regulatory References
			Requirements
	Drilling Waste Management		• EUB Guide 50: Drilling Waste Management • EUB Guide 70: Drilling Waste Disposal Inspection Manual
Well Completions	Commingling Production	Commingling Approval (EUB)	• Oil and Gas Conservation Regulations (AR 151/87) EUB Directive 65: Resources Applications for Conventional Oil and Gas Reservoirs
	Service rig operations		• EUB Guide 37: Service Rig Inspection Manual
	Completing a well for water injection or disposal	Well License	• EUB Guide 51: Injection and Disposal Wells – Well Classifications, Completions, Logging and Testing Requirements
Well Testing	Venting and Flaring	Flaring Permit (EUB)	• Oil and Gas Conservation Regulations (AR 151/87) • EUB Guide 60: Upstream Petroleum Industry Flaring Guide (plus updates) • AENV. 2004. Alberta Ambient Air Quality Objectives
	Pressure and Deliverability Testing		• EUB Guide 40: Pressure and Deliverability Testing Oil and Gas Wells – Minimum Requirements and Recommended Practices
CBM/NGC Wells – Produced Water Measurement	Determine Water Production at Gas Wells		• EUB Directive 004: Determination of Water Production at Gas Wells
	Reduction or exemption from well testing requirements (once every 12 months)	Approval (EUB)	• EUB Directive 004: Determination of Water Production at Gas Wells
Disposal Well	Complete and operate a disposal well on provincial lands	Ministerial Approval (AENV) Well License (EUB)	• Environmental Protection and Enhancement Act • Oil and Gas Conservation Regulations (AR 151/87) • EUB Guide 56: Energy Development Application Guide • EUB Guide 51: Injection and Disposal Wells – Well Classifications, Completions, Logging and Testing Requirements
	Complete and operate a disposal well on Indian lands	Approval (IOGC)	• Indian Oil and Gas Regulations, 1995 (SOR/94-753)
Well Integrity	Well Integrity Testing, Reporting and Repairs		• EUB Interim Directive ID 2003-01: 1) Isolation Packer Testing, Reporting and Repair Requirements; 2) Surface Casing Vent Flow / Gas Migration Testing, Reporting and Repair

Activity		Approvals or Authorizations Required (Regulatory Agency)	Legislation / Regulatory References
			Requirement; 3) Casing Failure Reporting and Repair Requirements.
Groundwater	Withdraw non-saline water from CBM/NGC formation	Authorization (AENV) License (EUB)	• Water Act. (Ch. W-3, RSA 2000) • Water (Ministerial) Regulation (AR 205/1998) • Alberta Environment. 2004. Guidelines for Groundwater Diversion – For CBM/NGC Development. • Alberta Environment. 2003. Groundwater Evaluation Guideline (Information Required when Submitting an Application under the Water Act). • Oil and Gas Conservation Act (Ch. O-6, RSA 2000). • Oil and Gas Conservation Regulations (AR 151/1971). • EUB Guide 56: Energy Development Application Guide.
	Produce and dispose saline water from CBM/NGC formation	License (EUB)	• Oil and Gas Conservation Act (Ch. O-6, RSA 2000) • Oil and Gas Conservation Regulations (AR 151/1971) • EUB Guide 56: Energy Development Application Guide
	Discharge of non-saline groundwater	Approval (AENV)	• Environmental Protection and Enhancement Act • Surface Water Quality Guidelines for Use in Alberta, November 1999
	Drill a water well (e.g., for drilling operations; for CBM/NGC facility utility water)	Authorization (AENV)	• Water Act. (Ch. W-3, RSA 2000) • Water (Ministerial) Regulation (AR 205/1998) • AENV 2003. Groundwater Evaluation Guideline (Information required when submitting an application under the Water Act)
Production Facilities	Construct and operate a compression or pumping facility (≥ 75 kW)	Facility License (EUB)	• Oil and Gas Conservation Regulations (AR 151/87) • EUB Guide 56: Energy Development Application Guide • AENV. 2004. Alberta Ambient Air Quality Objectives • EUB Directive 017: Measurement Requirements for Upstream Oil and Gas Operations • EUB Interim Directive ID 99-8: Noise Control Directive • EUB Guide 38: Noise Control Directive – User Guide • EUB Guide 55: Storage Requirements for the Upstream Petroleum Industry

Activity		Approvals or Authorizations Required (Regulatory Agency)	Legislation / Regulatory References
			• EUB Guide 58: Oilfield Waste Management Requirements for the Upstream Petroleum Industry • EUB Guide 71: Emergency Preparedness and Response Requirements for the Upstream Petroleum Industry
	Construct and operate a compressor station	Development Permit (local municipality)	• Municipal government (local authority)
	Construct and operate a compressor or pumping station, or sweet gas processing plant (emitting greater than 16 kg/hr NOx)	Registration (AENV)	• Environmental Protection and Enhancement Act (Ch.E-12, RSA 2000). • AENV – Code of Practice for Compressor and Pumping Stations and Sweet Gas Processing Plants
	Install a boiler or pressure vessel	Registration (Alberta Boilers Safety Association)	• Safety Codes Act (Ch. S-1, RSA 2000) • Boilers and Pressure Vessels Regulation (AR 227/75) • Design, Construction and Installation of Boilers and Pressure Vessels Regulation (AR 293/94)
	Install a pressure piping system.	Registration (Alberta Boilers Safety Association)	• Safety Codes Act (Ch. S-1, RSA 2000) • Boilers and Pressure Vessels Regulation (AR 227/75) • Design, Construction and Installation of Boilers and Pressure Vessels Regulation (AR 293/94)
	Install electrical systems		• Electrical Code Regulation (AR 145/2002)
	Install fire protection		• Fire Code Regulation (AR 52/98)
	Install buildings		• Building Code Regulation (AR 50/98)
	Production Operations		• EUB Guide 64: Facility Inspection Manual
	Install on-site power generating equipment	(EUB)	• EUB Guide 28: Applications for Power Plants, Substations and Transmission Lines
	Reporting emissions	(AENV) (Environment Canada)	• AENV – Terms and Conditions of Approval issued for production facility under EPEA • Environment Canada: National Pollutant Release Inventory
Pipelines	Construct and operate pipelines	Permit to Construct License to	• Pipeline Act (Ch. P-15, RSA 2000) • Pipeline Regulation (AR 91/2005)

Activity		Approvals or Authorizations Required (Regulatory Agency)	Legislation / Regulatory References
		Operate (EUB)	• EUB Guide 56: Energy Development Application Guide • EUB Guide 66: Pipeline Inspection Manual • Canadian Standards Association Standard Z662: Oil and Gas Pipeline Systems • EPEA (Ch E-12, RSA 2000) • AENV. Conservation & Reclamation Information Letter 94-5: Environmental Protection Guidelines for Pipelines • AENV Conservation & Reclamation Information Letter 01-04: Ploughed-in Pipelines
	Construct and operate pipelines with a length (in km) times outside diameter (in mm) with an index number of 2690 or greater – in White Area	Approval (AENV)	• EPEA (Ch.E-12, RSA 2000) • Activities Designation Regulation (AR 276/2003). • AENV. 1994. Guide for Pipelines: Pursuant to EPEA. ENV-66-P
	Pipelines - in the Green Area	(ASRD)	• Project-specific Environmental Field Report or a company's Area Operating Agreement
	Release greater than 1,000 m^3 of water from hydrostatic testing of a pipeline	Notification (AENV)	• Water Act. (Ch. W-3, RSA 2000). • Water (Ministerial) Regulation (AR 205/1998). • AENV Code of Practice for the Temporary Diversion of Water for Hydrostatic Testing of Pipelines
	Watercourse Crossings	Notification (AENV)	• Water Act (Ch. W-3, RSA 2000) • Water (Ministerial) Regulation (AR 205/1998) • AENV Code of Practice for Pipelines and Telecommunication Lines Crossing a Water Body
	Activities likely to alter or damage fish habitat	Authorization (Fisheries and Oceans Canada)	• Fisheries Act (Canada Ch. F-14) • Fisheries and Oceans Canada. Policy for the Management of Fish Habitat.
	Crossing navigable waters	Clearance Statement or Approval (Transport Canada - Canadian Coast Guard)	• Navigable Waters Protection Act (Canada Ch. N-22)
CBM/NGC	Spill response	Approval	• Oil and Gas Conservation Regulations (AR

Activity		Approvals or Authorizations Required (Regulatory Agency)	Legislation / Regulatory References
Operations	contingency plans for saltwater disposal well or liquid pipeline	(EUB)	151/1971) • Pipeline Regulation (AR 91/2005) • EUB Guide 71: Emergency Preparedness and Response Requirements for the Upstream Petroleum Industry
Well Suspension	Suspend a CBM/NGC well	(EUB)	• Oil and Gas Conservation Act (Ch. O-6, RSA 2000) • Oil and Gas Conservation Regulations (AR 151/1971) • EUB Directive 013: Suspension Requirements for Wells
Well Abandonment	Abandon a well on provincial lands	(EUB)	• Oil and Gas Conservation Act (Ch. O-6, RSA 2000) • Oil and Gas Conservation Regulations (AR 151/1971) • EUB Guide 20: Well Abandonment Guide
	Abandon a well on Indian lands	Written Approval (IOGC)	• Indian Oil and Gas Regulations, 1995. (SOR/94-753)
Facility Decommission	Decommission a facility	(EUB, AENV)	• Oil and Gas Conservation Regulations (AR 151/1971) • Conservation and Reclamation Regulation (AR 215/1996) • EUB Information Letter IL 98-02: Suspension, Abandonment, Decontamination, and Surface Land Reclamation of Upstream Oil and Gas Facilities
Land Reclamation	Reclaim provincial public lands used for geophysical program	Letter of Clearance (ASRD)	• Public Lands Act (Ch. P-40, RSA 2000) • Exploration Regulation (AR 214/98)
	Reclaim surface lease on provincial private lands	Reclamation Certificate (AENV)	• EPEA (Ch.E-12, RSA 2000) • Conservation and Reclamation Regulation (AR 215/1996) • AENV. Information Letter R&R/03-11: Upstream Oil & Gas Reclamation & Remediation Program – Information for Landowners
	Reclaim surface lease on provincial public lands	Reclamation Certificate (ASRD)	• Public Lands Act (Ch. P-40, RSA 2000) • ASRD. 2004. Public Lands Operational Handbook
	Reclaim surface lease on Indian lands	(IOGC)	• Indian Oil and Gas Act. (R.S. 1985, c. I-7) • Indian Oil and Gas Regulations, 1995. (SOR/94-753)
Royalties		Governs management & disposition of	• Mines and Minerals Act • Natural Gas Royalty Regulation

Activity		Approvals or Authorizations Required (Regulatory Agency)	Legislation / Regulatory References
		rights in Crown-owned mines and minerals, including levying and collecting bonuses, rentals and royalties	

Appendix E

Flaring and Venting Recommendations
For Coal Bed Methane
Final Report

Prepared by the
Flaring and Venting Project Team
for the
Clean Air Strategic Alliance
Board of Directors

March 2005

Flaring and Venting Recommendations
For Coal Bed Methane
Final Report

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By consensus, the CASA board of directors approved this report and the recommendations within at its March 17, 2005 meeting.

Download this report from the CASA Web site library at ***http://casahome.org***.

Acknowledgements

The Flaring and Venting Project Team gratefully acknowledges the commitment and support of the volunteers who generously provided their time and energy to this project.

About CASA

The Clean Air Strategic Alliance (CASA) is a non-profit association composed of stakeholders from three sectors – government, industry and non-government organizations such as health and environmental groups. All CASA groups and teams, including the board of directors, make decisions and recommendations by consensus. These recommendations are likely to be more innovative and longer lasting than those reached through traditional negotiation processes. CASA's vision is that the air will be odourless, tasteless, look clear and have no measurable short- or long-term adverse effects on people, animals or the environment.

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Contents

Acknowledgements i

About CASA i

Contents ii

Glossary of Terms and Acronyms iii

1. Introduction 1

2. Existing Framework for Flaring and Venting of Coal Bed Methane 1

   A. EUB Guide 60 1

   B. Flaring and Venting Project Team Recommendations – September 2004 2

3. Flaring and Venting for Coal Bed Methane in Alberta 2

   A. An Overview of Wet and Dry Coal Bed Methane in Alberta 2

   B. Recommendations for Dry CBM 3

   C. Recommendations for Wet CBM 4

   D. Nitrogen Injection and Flaring 5

4. Framework Review 5

Appendix A: Flaring and Venting Project Team Revised Terms of Reference 6

Appendix B: Flaring and Venting Project Team List of Members 8

Glossary of Terms and Acronyms

CAPP: Canadian Association of Petroleum Producers

CBM: Coal bed methane

CSUG: Canadian Society for Unconventional Gas

EUB: Alberta Energy and Utilities Board

Flaring: Flaring is the burning of natural gas that cannot be economically conserved.

FVPT: Flaring and Venting Project Team

Guide 60: Refers to EUB *Guide 60*, June 1999 and *Guide 60: Updates and Clarifications*, February 2001. The EUB regulates upstream petroleum industry flaring and venting according to the methods outlined in this Guide.

MAC: Multi-Stakeholder Advisory Committee, a multi-agency group led by Alberta Energy, and co-chaired by Alberta Environment, charged with reviewing and making recommendations on CBM development in Alberta.

Mcf: Thousand cubic feet

MMscf/D: Million standard cubic feet per day

NGC: Natural gas from coal

SEPAC: Small Explorers and Producers Association of Canada

Tcf: Trillion cubic feet

Venting: Venting is the release of natural gases to the atmosphere where conservation or flaring is not practical due to gas volumes being too small or incapable of supporting combustion.

1. Introduction

Coal bed methane (CBM), also known as natural gas from coal (NGC), is showing promise as an important new source of energy in Alberta. It is estimated that there is over 550 Tcf of CBM in the province. Although there are not yet many CBM wells currently in commercial production, a large number of exploratory wells are being drilled, especially in the shallow coal deposits underlying the Calgary-Edmonton corridor east of Highway 2. There were an estimated 2400 wells province-wide by the end of 2004, producing over 100 MMscf/D of CBM.

CBM has been undergoing a review since 2003 by a Multi-stakeholder Advisory Committee (MAC) led by Alberta Energy and co-chaired by Alberta Environment.[1] In spring 2004, the MAC agreed that the CASA Flaring and Venting Project Team (FVPT) should develop recommendations for the regulation of flaring and venting associated with CBM development.

In June 2004, the CASA board of directors approved the addition of the following objective to the Terms of Reference for the Flaring and Venting Project Team:

> 10. Review information and develop recommendations for the regulation of flaring and venting associated with coal bed methane natural gas from coal development.

Stakeholders from the Canadian Society for Unconventional Gas (CSUG), the industry association for CBM development, were subsequently invited to participate in this part of the team's work.

The project team's focus was around reducing the amount of gas that flared or vented before the well produces commercially viable volumes of gas. Once approved by the CASA board of directors, the recommendations will be provided to the Alberta Energy and Utilities Board (EUB) for inclusion in *Guide 60*.[2]

2. Existing Framework for Flaring and Venting of Coal Bed Methane

A. EUB Guide 60

The EUB regulates flaring and venting for gas wells through performance and reporting requirements, permits, and data collection, as detailed in *Guide 60*. Because no significant water is encountered, dry CBM wells are tested in a manner similar to conventional shallow gas wells, and the same rules and regulations apply.[3] *Guide 60* requirements are viewed by the project team as largely adequate for testing of dry CBM wells.

Due to the extended (over one year) dewatering period required for testing of wet CBM wells, especially during early evaluation and piloting, some believe that the extended duration tests and higher volume limits for these types of CBM test wells may, in the future, require some modification to *Guide 60*.

Venting is not permitted by the EUB except in cases where the gas is not able to support stable combustion. This may occur when the gas flow rates are very low or intermittent, or when the extracted gas cannot be ignited due to insufficient energy content. Low energy content can result

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[1] For more information on the work of the MAC, see http://www.energy.gov.ab.ca/335.asp

[2] *Guide 60* (June 1999) and *Guide 60: Updates and Clarifications* (February 2001) may be viewed or downloaded at http://www.eub.gov.ab.ca/BBS/requirements/Flaring/default.htm.

[3] See section 3.8 of *Guide 60*: Well Test Flare Volumes and Approval Requirements.

from high levels of nitrogen being flowed back after nitrogen fracturing operations. In these cases, the gas may be vented initially but must be flared once it is capable of supporting combustion.

B. Flaring and Venting Project Team Recommendations – September 2004

In September 2004, the CASA board of directors approved recommendations put forward by the FVPT regarding well test flare management. In addition to recommendations for improved public notification of well test flaring activities, the FVPT agreed that flaring and venting should only be conducted long enough to determine the economic viability of gas conservation and the data necessary to size the conservation equipment.

The FVPT did not reach agreement on the length of time that this would require. It was proposed and accepted that data be gathered that would allow the duration requirements of well tests to be assessed. Where warranted, extensions would be provided for an agreed to set of reasons. If an extension is needed for a specific well, reasons for the extension should be provided to the EUB.

The Flaring and Venting Project Team is to be reconvened in Q2 2005 to review the data and develop recommendations regarding the time limit for well testing, including reasons for extensions, for implementation no later than January 1, 2006.

3. Flaring and Venting for Coal Bed Methane in Alberta

There were several issues that the FVPT considered in its review of flaring and venting for CBM:

- The definition of wet and dry CBM
- The need for different requirements for flaring and venting of a) wet and b) dry CBM
- The need for more data or information with respect to certain matters
- Nitrogen injection and its impact on flaring and venting of CBM wells

These issues and corresponding recommendations are described below.

A. An Overview of Wet and Dry Coal Bed Methane in Alberta

Each CBM basin poses its own unique challenges. In some formations, the coal is dry and CBM can be extracted in the same way as conventional natural gas from shallow formations ("dry CBM"). In other formations, the coal must be dewatered to reduce the pressure and allow the gas to be extracted ("wet CBM").

Because CBM is predominantly clean-burning methane and contains no heavy hydrocarbons, the flares are similar to the flames that burn in home furnaces, except larger in scale. Neither sour gas nor heavy hydrocarbons are associated with Alberta's CBM and therefore do not complicate testing practices for these wells.

Currently, most CBM wells are found in one of the following three CBM formations in Alberta: Horseshoe Canyon, Mannville and Ardley (see Figure 1). Due to their flow characteristics, pressures and gas quality, "dry" Horseshoe Canyon wells are analogous to conventional shallow gas wells commonly found in Alberta and comprise about 90% of the CBM well activity to date, including several commercial wells. The Mannville and Ardley formations may be wet CBM wells that require extensive dewatering periods in the early exploration and pilot stages, and must be tested for long periods to evaluate their potential. No commercial wells exist in these latter areas at this time.

B. Recommendations for Dry CBM

Figure 1: Alberta Coal Zones with CBM Potential (courtesy EUB)

The FVPT has classified dry CBM wells as CBM wells producing less than $1m^3$ of water per operating day.[4] As noted above, these wells are in most respects similar to conventional shallow gas wells in Alberta. Venting is not recommended and short-term flare tests with relatively small test volumes are the deemed practice. Nonetheless, the FVPT agreed that additional data should be collected and that the FVPT should reconvene to review the data to determine if any additional recommendations are warranted in relation to the time period for flaring and venting of dry CBM wells.

[4] For all recommendations in this report, the water rate used to specify the difference between wet and dry CBM wells for the purposes of gas flaring or venting has no effect or relation to compliance with any requirements in the Water Act. CBM operators are required to follow the "Alberta Environment Guidelines for Groundwater Diversion for Coal bed Methane Natural gas-in-coal Development - April 2004" whenever non-saline groundwater is anticipated to be encountered in their operations, regardless of the rate or volume of non-saline groundwater that may be produced.

Accordingly, the FVPT recommends the following:

1. The EUB, in partnership with CAPP and SEPAC, set up a program to collect one month of data on the flaring and venting associated with CBM wells producing less than 1m^3 of water per operating day across the province. Data to be collected includes the duration of flaring and or venting, volumes of gas flared and or vented, and reasons if the flaring and or venting extends longer than 72 hours.

2. The Flaring and Venting Project Team be reconvened in Q2 2005 to review the data and develop recommendations regarding the time period for flaring and venting associated with CBM wells producing less than 1m^3 of water per operating day for implementation January 1, 2006.

3. Until January 1, 2006, for CBM wells producing less than 1m^3 of water per operating day, flaring and venting (including clean up and testing) is limited to a total period of 120 hours for development wells and 720 hours for other wells (period is not necessarily consecutive, i.e. excludes shut-in time) per zone tested unless an extension has been specifically granted by the EUB.

4. If additional time for flaring or venting of CBM wells producing less than 1m^3 of water per operating day is needed, the EUB must be contacted as soon as possible with the reasons for the extension, but not later than the end of the 120 or 720 hour period.

   Extensions may be granted:

   - To clean up the well bore in unique situations;
   - Where stabilized flow has not been reached; or
   - Where there have been mechanical problems with the well.

   After the well test, the well must be shut-in until gas conservation is implemented.

5. Existing flaring permit thresholds continue to apply as outlined in *Guide 60: Updates and Clarifications* available at http://www.eub.gov.ab.ca/bbs/products/guides/g60_g60-updates.pdf. This includes a permit threshold of 200 10^{3}m^3 for wells which are already tied in, 400 10^{3}m^3 for development wells, and 600 10^{3}m^3 for exploratory wells. These thresholds correspond to Tier 3, Tier 2, and Tier 1 as defined in *Guide 60* (see section 3.8.1, Feb 2001, *Guide 60: Updates and Clarifications*).

C. Recommendations for Wet CBM

The FVPT has classified wet CBM wells as CBM wells producing more than 1m^3 of water per operating day.[1] Wet wells need dewatering that may take several months to determine if the well is commercial.

Accordingly, the FVPT recommends the following:

6. For CBM wells producing more than 1m^3 of water per operating day, flaring or venting must cease (gas must be conserved) within 6 months of gas production for an individual well exceeding 100 10^{3}m^3 for any three-month period (approx. 1100 m^3/day). Shorter tie-in periods must be pursued whenever possible. Operators must notify the EUB as soon as gas

[1] See footnote 4

production exceeds 100 10^3m^3 for any three-month period at a CBM well producing more than $1m^3$ of water per operating day that is flaring or venting.

For CBM wells producing more than $1m^3$ of water per operating day that do not trigger the above (i.e. 100 10^3m^3 for any three-month period), flaring and venting is limited to the lesser of:

- a total period of 18 months, including the period to tie the well in, or
- a total volume of 400 103m3 for Tier 2 (development) wells or 600 10^3m^3 for Tier 1 (other) wells, per zone tested. Wells that are already tied-in would be treated as Tier 3 and allowed a maximum flare volume of 200 103m3.

7. If additional flare times or volumes are needed to test a CBM well producing more than $1m^3$ of water per operating day, the operator must make a written request for such to the EUB as early as possible and in no case later than the end of the 18 month or volume allowance flare or vent period. Any extension request must include the reasons for the extension. Extensions may be granted to allow for additional flare time or volume for reservoir evaluations or where other special circumstances warrant.

D. Nitrogen Injection and Flaring

Nitrogen gas is used by the industry to "fracture" dry CBM wells. It also makes up approximately 80% of the air that we breathe. Fracturing opens channels in the CBM formation that allow more gas to flow to the well. After fracturing the formation, the nitrogen must be flowed out of the well during a "clean-up" phase. Initially, the produced gas from the well cannot be flared because nitrogen levels reduce the energy content of the gas, rendering it incombustible. As the clean-up continues, nitrogen levels decrease, allowing ignition of the gas. The gas produced during the clean-up phase cannot be tied into sales gas pipelines because of the energy content and nitrogen concentration required by the purchase agreements' specifications.

At this time, it is not known whether there are other economically feasible technologies that could be used for dry well clean-up or whether there are other technologies that can be used to remove nitrogen from dry CBM wells. One of the challenges is the continuous decline of nitrogen concentration in the gas stream as clean-up occurs.

The Flaring and Venting Project Team therefore recommends:

8. A literature review should be conducted by CAPP by May 31, 2005 to determine whether there are any methods other than flaring or venting to remove nitrogen from CBM wells.

9. Operators of wells negotiate to allow gas with higher nitrogen content to be delivered into pipelines.

4. Framework Review

In keeping with a previous recommendation regarding review of the entire flaring and venting framework in 2007, as approved by the CASA board of directors in September 2004, the FVPT recommends as follows:

10. The Flaring and Venting Project Team review the flaring and venting framework for Coal Bed Methane when it reconvenes in the first quarter of 2007.

Appendix A: Flaring and Venting Project Team Revised Terms of Reference

Flaring/Venting Project Team
Revised Terms of Reference

Purpose:

- To assess the performance and make recommendations regarding the Alberta solution gas flaring management framework.
- To develop recommendations to address a broader range of flaring and gas venting issues in Alberta.

Objectives:

1. Determine whether the solution gas flaring reduction targets for 2000 and 2001 have been met.
2. Determine, based on improved information, firm future reduction targets, time lines and threshold volumes for solution gas flaring.
3. Evaluate the royalty treatment of flared and vented gas and cost sharing programs and their implication for achieving future reduction targets.
4. Evaluate the approval process and determine if fixed term approvals are required.
5. Review performance requirements and efficiency standards, and determine the feasibility of combustion efficiency standards for all flares.
6. Assess research findings and their implication for management of flaring and venting.
7. Review information on gas venting and mitigation approaches and recommend a venting management framework, including short-term actions and long-term strategies.
8. Review and develop recommendations with regard to EUB Guide 60, and Guide 60 Update and Clarifications document.
9. Develop recommendations for a strategy to respond to the issues associated with flaring and venting.
10. Review information and develop recommendations for the regulation of flaring and venting associated with coal bed methane natural gas from coal development.

Note: Objectives 1-6 came from Section 6.0 of the CASA Flaring Project Team's 1998 report: *Management of Routine Solution Gas Flaring in Alberta*. To reflect the broader scope of the Flaring Venting Project Team, objectives 3 and 6 have been expanded to include all flaring and venting, and objective 5 to include all flaring.

Context:

The Terms of Reference for this project team supports the objectives identified in CASA's *Business Plan 1999-2001*, fits well within the priorities, values, and expectations of the board, and is in accordance with the CASA vision for air quality.

Recommendations developed by the project team will reflect CASA's goals for air quality in Alberta, namely: 1) Protect the environment, 2) Optimize economic performance and efficiency, and 3) Seek continuous improvement.

Report to the CASA Board:
The Flaring and Venting Project Team will report to the CASA board of directors in September 2004, with an addendum to that report that will focus on recommendations relating to on Coal Bed Methane development to follow in November 2004.

Membership:
The Alberta Energy and Utilities Board

Alberta Department of Energy

Alberta Environment

Upstream Oil and Gas Industry, both heavy oil and conventional oil

Alberta Association of Municipal Districts and Counties

Prairie Acid Rain Coalition

Alberta Health and Wellness

Resident for Accountability in Power Industry Development

Small Explorers and Producers Association of Canada

Alberta Cattle Commission

Pembina Institute

Wild Rose Agricultural Producers

Canadian Association of Petroleum Producers

FVPT – Coal Bed Methane Final Report 7

Appendix B: Flaring and Venting Project Team List of Members

Name	Organization Name
Karina Bodo	Alberta Health and Wellness
Michael Brown	Alberta Energy and Utilities Board (EUB)
Terri Carroll	Small Explorers & Producers Association of Canada (SEPAC)
Jeff Cormier	Alberta Department of Energy
Peter Davis	Government of BC, Oil and Gas Commission
Keith Denman	Clean Air Strategic Alliance
Gus Dhaliwal	Alberta Department of Energy
Randy Dobko	Alberta Environment
John Drinkwater	BP Canada
Bart Guyon	Alberta Association of Municipal Districts and Counties
Chris Hay	Imperial Oil CPPI
Wayne Hillier	Husky Energy
Ahmed Idriss	Clean Air Strategic Alliance
Martha Kostuch	Bert Riggall Environmental Foundation & PARC
Alexander MacKenzie	Alberta Health and Wellness
John Parr	Canadian Natural Resources Limited
Ian Pearce	Residents for Accountability in Power Industry Development (RAPID)
Mike Queeman (Alt)	Residents for Accountability in Power Industry Development (RAPID)
Barry Ranger	Small Explorers & Producers Association of Canada (SEPAC)
Doreen Rempel	MGV Energy Inc. CSUG
Michael Rodyniuk	Alberta Beef Producers
Chris Severson-Baker	Pembina Institute
Al Smandych	Alberta Energy and Utilities Board (EUB)
Ralph Smith	Wildrose Agricultural Producers
Jim Spangelo	Alberta Energy and Utilities Board (EUB)
John Squarek	Canadian Association of Petroleum Producers (CAPP)

FVPI – Coal Bed Methane Final Report 8